

## Evaluation of genetic trends for milk yield and somatic cell counts in the Holstein breed in terms of changes in the lactation curve

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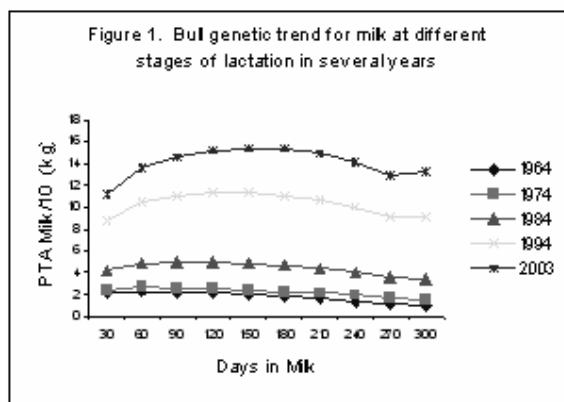
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**Introduction** The use of test day model (TDM) for genetic evaluation results in predicted transmitting abilities (PTAs) for any stage of lactation. However, in the United Kingdom (UK), publication and selection of parents are still based on PTAs computed on a 305-day basis from the random regression coefficients of the TDM. It is expected from selection index theory, that selection on 305-day PTAs would place different weights on PTAs at different days in milk (DIM). This could result in changes in the lactation curve of animals over time as a result of genetic progress. This study evaluates genetic trends in terms of changes in PTAs at different DIM for production traits and somatic cell counts (SCC) in the Holstein breed. In addition, the inclusion of SCC in the national profitable life index (£PLI) is based on its relationship with milk computed on a 305-day basis. This study also examines what impact such selection has on the relationship between PTAs for milk and SCC at different DIM.

**Materials and methods** PTAs for 305-day and 10 stages of lactation for bulls and cows were computed from the first parity random regression coefficients of the official August 2008 TDM evaluation for the Holstein breed for milk in the UK. Details of the TDM have been described by Mrode *et al* 2005. Similarly, a TDM for first parity SCC was implemented fitting Legendre polynomial of order 1 and 2 for animal effect and permanent environment (Mrode and Swanson, 2003). The analysis for production traits involved 6,450,558 cows born from 1974 to 2006 and with about 58 million test day (TD) records. A total of 3,294,634 heifers born 1986 to 2006 with 27,895,096 TD records were evaluated for SCC. Genetic trends were estimated for 305-day and different DIM by regressing PTAs on the year of birth. The percentage contribution of the trend at each DIM to the overall trend was computed. The average genetic lactation curve was examined over time. Correlations of PTAs for milk and SCC for bulls with at least 50 daughters for both traits were computed at 305-day basis and different DIM; then changes in the relationship between both traits over DIM were examined.

**Results** Bull genetic trends for first parity milk 36.118kg per year over the period 1964 to 2003. The rate of change for PTAs at 120 – 210 DIM accounted for 43% of the trend observed on the 305-day basis, with changes for PTAs at 30 DIM accounting only for about



7-8%. In general the highest rate of change (11%) was observed for PTAs at 150 and 180 DIM. Figure 1 illustrates that genetic progress has resulted in the shift of the peak of the curve from day 60 in 1964 to 150 in 2003.

This shift was similarly observed when analysis was done within bulls originating from countries with mainly pure Holstein populations, so it is not due only to changes in breed composition. The cow genetic trend for milk was 38.465kg/year on 305-day basis, with about 11% of the change observed at 150 DIM. The plot of the genetic curve for cows followed the same pattern as bulls. In contrast, the rate of change for SCC was linear with DIM in milk, with +36, +1 and -22% of the rate for 305-day basis contributed by SCC PTAs at 30, 210 and 305 DIM. The genetic curve for SCC indicates that this linear increase has declined with time. It seems that the reduction in SCC as a result of selection has mainly been due to reduction in SCC at mid to later stages of lactation. This is consistent with estimates of correlation between Bull PTAs for milk and SCC. While the

correlation of 305-day milk and SCC PTAs was 0.22, the estimate between 305-day milk PTA and SCC PTAs at 30, 150, 270 and 305 DIM were 0.41, 0.30, 0.06 and 0.01. This indicates a stronger antagonistic relationship between milk and SCC at early stages of lactation.

**Conclusion** The rate of change of milk PTAs at various DIM was greatest at about mid lactation. Thus genetic progress has been accompanied by a shift in the peak of the genetic lactation curve. While there has been a decrease in SCC at late lactation, rate of SCC seems to have increased in early lactation.

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### References

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