The evaluation of Holstein Friesian sires for calving ease in the UK

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INTRODUCTION

The economic impact of difficult calvings and calf mortality are well-recognised in both dairy and beef breeds, and procedures to identify bulls which lower the incidence of these problems have been established in most major dairying countries. Since the early studies of Philipsson (1976a,b), there have been major developments in the statistical procedures employed in such evaluations, to more adequately account for the binomial or categorical nature of the observations, but many of the recommendations made by Philipsson, Foulley, Lederer, Liboriussen and Osinga (1979) are still employed to-day.

The main aim of this paper is to briefly summarise a recent study of dairy calving survey data collected for Holstein Friesian bulls in the UK. However, we will also attempt to relate the results of this and similar studies to the recommendations made by Philipsson et al (1979), on calving survey traits generally.

EVALUATION OF HOLSTEIN FRIESIAN CALVING SURVEY RECORDS IN THE UK

Background

One peculiarity of the UK dairy industry is that calving survey traits are not recorded routinely by milk recording organisations, and the only systematic recording is associated with progeny testing schemes. That information is usually gathered by survey from participating farmers, although, to date, there has been no formal agreed procedure as to the analysis and presentation of those results.

The situation as described for the UK has a number of important consequences:

(a) It is not possible to relate the genetic merit of test bulls for calving survey traits to predictions for bulls tested in other countries.

(b) Test semen is used over cows which the farmer chooses, and these might not be a representative sample of his herd. For example, in the data set described below, only three percent of the records are for heifers.

(c) With only a small number of doses of test semen used per herd, it is not possible to accommodate herd effects in the model of analysis.

Data

Over 75 thousand records were collected by survey over the period 1988 until 1994 in what was previously known as the Milk Marketing Board's (MMB) Dairy Progeny Testing Scheme (DPTS), and more recently as the Genus Sire Improvement Programme (GSIP). There is no obligation on farmers to use test semen. and various incentives are offered to obtain their involvement. The aim has been to use a minimum of 400 doses of test semen, to yield 200 effective calving records. Farmers are not able to nominate which test bulls they use, and their identity is only made known after the insemination. Data analysed here included calving survey records on 685 sires, of which 359 (44.3%) were purebred Holstein, but the sample contained an average of 25 per cent British Friesian genes.

Traits

Data were available on four traits, Calving Difficulty Score, Gestation length, Calf Mortality and Calf Size. Records were included where information on all four traits was available.

Calving Difficulty Score : Farmers are asked to classify a calving as Easy (1), or presenting Slight (2) or Serious Difficulty (3), with the latter category including Caesarean deliveries In these data, 85.8% of calvings were recorded as Easy, 12.5% as presenting Slight Difficulty and 1.8% as Seriously Difficult.

Gestation Length: This is calculated as the difference between insemination and calving dates. The modal gestation length was firstly identified for each calf sex * cow age (heifer or adult) combination, and records rejected if they fell outside 15 days of this modal value (Philipsson, et al 1979).

Calf Mortality: This was defined as whether the calf died (1) or survived (0) within 48 hours of birth. Overall, 5.3% of calves were recorded as dead.

Calf size: Farmers were asked to score the calf as Large (1), Average (2) or Small (3). The percentages falling into these three classes were as follows:

Large	14.3%
Average	80.8%
Small	4.9%

Initially, 89045 calving records were present in the file considered for analysis. Data were then excluded if they were from cows other than Holstein Friesians, having a single non-induced birth, records had to be complete for all four traits, and both the sex of the calf and age of the cow had to be known. These checks reduced the file to 75685 records, or 85.0% of the original data set. A full report of the analyses undertaken will be reported elsewhere (McGuirk, Gilmour and Going, in preparation).

Statistical Analysis

Analyses undertaken to identify non-genetic sources of variation used the statistical package REG (Gilmour 1994), and employed least squares procedures. Genetic parameter estimates were obtained using the package REMLPK (Meyer, 1986), on data on the observed scale. Heritability estimates for all traits and predictions of sire genetic merit (Transmitting Ability) for calving difficulty score on the underlying scale were obtained using REG, assuming a threshold model. All genetic analyses were undertaken using a sire model only, and the sires were assumed to be unrelated. The average number of records per sire was 127, and the average effective number of calving records per sire, obtained by comparison with the number of contemporary records in six-monthly year-season periods, was 48.

RESULTS AND DISCUSSION

Initially factors included in these analyses included the Year of Calving, Month or Season of Calving, the Cow Age (heifer or adult), Calf Sex (bull or heifer), proportion of Holstein genes, and the Cow Age * Calf Sex interaction. All were significant for Calving Difficulty Score, and all but proportion of Holstein genes were significant for calf mortality. In brief, average calving difficulty score and calf mortality were higher for male calves than for females, higher for heifers than cows, higher in the winter than the summer, while average calving difficulty score also increased with increasing proportion of Holstein genes in the sire.

In a subsequent set of analyses, on over 14000 records collected in 1993 and 1994, regional differences were found to be significant, while classifying cows into more than two age groups also accounted for an increased proportion of the variation.

For routine genetic evaluation, the records were classified according to six-monthly year/season periods, with linear trends on month of calving within periods. For the present, only cow and heifer age groups have been used, while regional effects have also been ignored, as information on lactation number and regions is only available on a small part of the complete data set.

Heritability estimates are summarised in Table 1. They are broadly in line with previous studies,(see Meijering, 1984 and Manfredi, San Cristobal and Foulley, 1991 for reviews), and also show that estimates for the categorical and binomial traits are higher on the underlying than on the observed scale. The genetic correlation estimates are also in line with previous studies, with increasing calving difficulty being associated with longer gestations, higher mortality and larger calves.

Table 1: Summary of Heritability and Genetic Correlation Estimates

Trait	Heritability Estimates		Genetic
	Observed Scale	Underlying Scale	Correlation with CDS
Calving Difficulty Score (CDS)	0.05 (.005)	0.12	-
Gestation length	0.45 (.025)	-	0.34 (.05)
Mortality	0.02 (.003)	0.12	0.52 (.07)
Calf Size	0.08 (.007)	0.13	-0.81 (.03)

Figure 1 summarises standardised transmitting abilities for calving difficulty score, for 564 sires with a minimum reliability of 50 per cent. While approximately normal, the modal class is less than the mean, and the distribution otherwise slightly skewed to the right, suggesting that some improvements to the model used are possible.

MATTERS OUTSTANDING

We will now consider what we see as matters raised by Philipsson et al (1979), but where we believe further information, clarification or agreement is required.

Long term changes in Calving Difficulty and Calf Mortality:

To date, the main focus of research on these traits has been to identify "easy calving sires", for use on heifers in particular, and other categories of cows which are at risk. However, in the overall context of breeding objectives for the dairy industry, these traits are generally either not considered, or treated separately from the major production and type traits. What are the likely effects on calving difficulty and calf mortality of our current breeding programmes, and are these problems likely to increase ? What is the importance of these traits as breeding objectives?

Do we have estimates of past genetic trends for these traits ? As regards likely future changes, it would be a comparatively simple exercise to look at correlations between predictions of sire genetic merit for calving survey traits, and those for production and type traits.

Are Calving Difficulty and Calf Mortality the same Traits in Heifers and Cows?

This is an important question in the UK, given our limited recording programme, especially on heifers, when our major interest is in identifying bulls suitable for use on heifers.

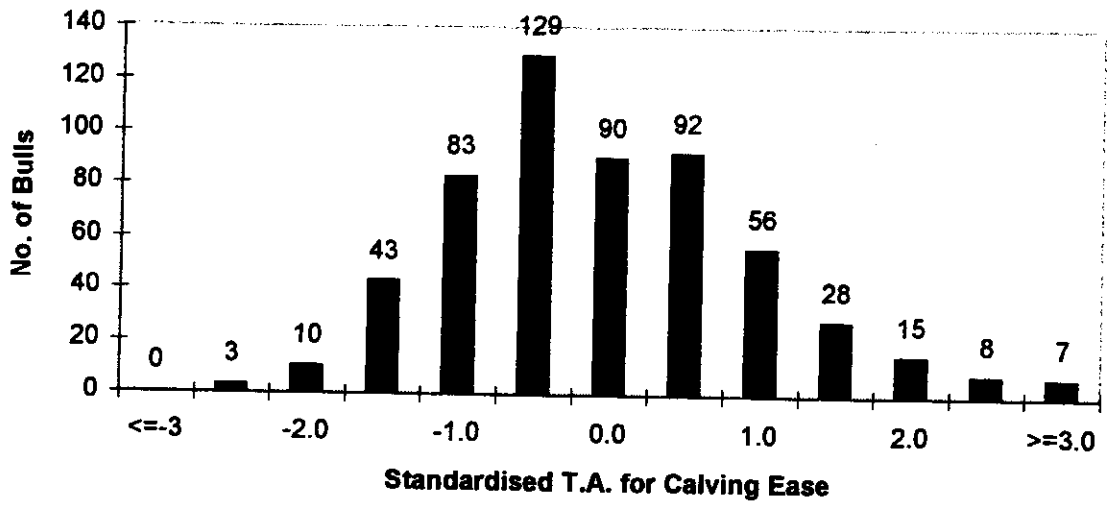
Evidence on the genetic correlation between these traits recorded on heifers and cows is limited. While Thompson, Freeman and Berger (1981) estimated a genetic correlation of 0.84 for a sample of US data, a number of Israeli studies have consistently given lower estimates, in the region of 0.5 (see for example Weller, Misztal and Gianola (1988). How general are these Israeli results, or are they peculiar to their management system? If their results are general, what then should we do, if our major interest is in predicting performance of sires when used over heifers? Philipsson et al (1979) proposed the use of correlated traits (gestation length, calf birth weights etc.), which might hopefully improve the accuracy of predictions for heifers. How beneficial might that be ?

Presentation of Sire Predictions

To date, no decision has been made in the UK as to how sire predictions for calving survey traits should be presented. More generally, achieving some degree of uniformity in presentation across countries would be desirable for the UK breeders and AI organisations, given the widespread use of imported semen.

Philipsson et al (1979) proposed a system of presenting predictions of genetic merit for sires in standard deviations units, with a likely range of from -2 to +2. Breeders using US and Dutch semen in the UK are more familiar with predictions of the expected incidence of seriously difficult calvings. The US system gives actual predictions, while the Dutch present their results as deviations from an average. That difference aside, such "backtransformation" of sire predictions to the level of expected incidences will lead to distributions which are skewed (see Berger, 1994), to a degree which depends on the population average. In addition, at the level of expected incidences, the probability of finding bulls which are extreme in terms of low calving difficulty is also affected by the population incidence assumed.

Distribution of Standardised Transmitting Ability for Calving Ease



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