LENGTH OF PRODUCTIVE LIFE FOR HOLSTEIN-FRIESIAN COWS RAISED ON LARGE SCALE FARMS IN KENYA

J.M.K.Ojango[1], V. Ducrocq[2] and G.E. Pollott[3]

[1]Egerton University, Box 536, Njoro, Kenya
[2] Station de Génétique Quantitative et Appliquée, INRA, 78352 Jouy-en-Josas, France
[3] Imperial College of Science, Technology and Medicine at Wye, Ashford, Kent TN25 5AH, UK

INTRODUCTION

The Holstein-Friesian breed is popular for its potentially high milk producing ability and is reared across all farming systems in Kenya. The breed has attractive capabilities for a country where milk supply is not yet able to meet the demands of the growing population. Information on the productive herd-life of these animals in the Kenyan environment is scarce, yet length of productive life (LPL), defined as the time from first calving to departure from the herd, is a trait of considerable economic importance: herd life combines traits related to production, health, fertility and workability. A longer life decreases the cost of replacement per year, leads to a higher proportion of cows in later higher producing lactations, and means less culling for diseases (Ducrocq *et al*., 1988 ; Essl, 1998 ; Strandberg, 1996). Genetic evaluation of herd life is important as a method of monitoring a population particularly if increasing milk yield beyond some point becomes antagonistic to survival (Essl, 1998 ; Smith and Quaas, 1984). The objectives of this study were : to evaluate the environmental factors affecting LPL of Holstein-Friesian cattle raised in Kenya ; to determine the pattern of variation in LPL for offspring of sires from different countries that are used in Kenya ; to assess the effects of productivity in the first lactation on LPL of Holstein-Friesian cattle in Kenya.

MATERIAL AND METHODS

Data. The length of productive life of 1355 Holstein-Friesian cows born from 1987 to 1997 on four large-scale farms identified as Holstein-Friesian breeders in Kenya and registered by the Dairy Recording Services of Kenya (DRSK) was analysed. The farms were selected based on their maintaining complete pedigree records for all animals before 1980 to the present. The farms were located in the Rift Valley province of the country which is classified as having medium to high potential for agricultural production. Characteristics of the farms have been described previously (Ojango, 2000). An animal's record was considered censored if the animal was sold to another herd, or if the animal was still alive as at August 1997. Records of animals that were older than 3000 days were also considered censored.

The data from the farms consisted of total milk yields from lactations of varying lengths, hence records were adjusted to a 305-day yield as described by Ojango and Pollott (2001). Animals were grouped into classes of milk production within a herd based on their first lactation 305-day adjusted milk yield. There were five classes of milk production per herd, each comprising 20% of the animals in a herd. Herd-year-seasons were defined using the rainfall pattern from 1985-1997 from which a green season and a dry season were determined.

Statistical analysis. A fully parametric Weibull model, including fixed effects of herd, year-season, age at first calving and class of milk production within herd as well as a random (logamma) herd-year-season (HYS) effect was used to analyse environmental effects (and their change over time) on the risk of culling. The fixed within-herd class effect of milk production in the first lactation was included to account for culling because of low milk production in the first lactation. In a second step, in order to relax the assumption of the Weibull model, a Cox model (Klein and Moescheberger, 1997) was used assuming that the HYS loggamma parameter was already known from the Weibull analysis. The effect of the sire's country of origin, and an interaction between the sire's country of origin and the class of milk production within herd were included. All models were fitted using the Survival Kit of Ducrocq and Sölkner (1998). It was checked that the sire's country of origin and the herd effects were not confounded. In this study, the number of records was not sufficient to enable genetic evaluation of individual sires.

RESULTS AND DISCUSSION

A total of 533 records were censored, comprising 39.3% of the data. The average length of productive life of the censored cows was 1215 days, whereas the average LPL for uncensored cows was 1113 days.

Influence of systematic environmental effects on LPL. Differences in mean milk production in the first lactation and average failure times for various levels of the main class effects are presented in Table 1. The fixed effects of herd, year-season, milk yield class, and sire country of origin all significantly affected the LPL. Considerable differences between herds in average LPL and in relative culling risk were observed. The huge variability in culling policies among the various farms also existed over time : an estimate of 2.65 was obtained for the loggamma parameter γ for HYS, corresponding to a (large) variance of 0.457. Animals in the lowest 20% milk yield class and in the highest 20% yield class in first lactation had a lower age at failure than those with intermediate levels of milk production. The effect of age at first calving on LPL was not significant.

Effects of the sire's country of origin on LPL. The Kaplan-Meier (raw) survival curves for cows sired by bulls from different countries are presented in Figure 1. Note that few cows that are offspring of Israeli or "other" sires were in the data set and for a shorter period: the corresponding survival curves should be interpreted with care. Differences in survival of daughters of sires from different countries were quite large (up to 25%, 1000 days after first calving). The pattern of variation in culling risks for different classes of milk production and for daughters of sires from different countries is presented in Figure 2. The relative culling risk of cows from sires originating from Kenya was 16% to 60% higher on average than those of sires from other countries (excIuding Israel). However, the higher risk may be primarily the direct consequence of a higher voluntary culling for milk production, as illustrated by the large estimates of relative risk for the low production classes for cows from Kenyan origin, while for the best two production classes, the relative risk was less influenced by the country of origin. For daughters of foreign sires, the risk of being culled only slightly increases when the level of first lactation milk production decreases: limited voluntary cullings seem to have occurred.

Very high yielding animals in the Kenyan environment tend to have problems with mastitis and fertility.

Table 1. Summary statistics for number of records, mean age at failure (days), mean 305-day milk yield (kg) in first lactation and mean 305-day milk yield (kg) for animals that failed to survive at various levels of fixed effects affecting LPL

Fixed effects	P-val.[A]	Number of records	Nuber of culled cows	Average age at failure in days	Mean 305d milk yield	Mean 305d milk yield for observed failures
Herd	***					
2		414	334	896	3634	3356
3		641	347	1274	4234	3788
4		177	103	1022	2935	2796
5		123	38	1797	4608	4032.
Milk yield class	***					
0 - 20%		271	213	915	2443	2384
20-40%		271	186	1127	3179	3148
40-60%		271	182	1213	3673	3611
60-80%		271	159	1316	4391	4339
80-100%		271	82	982	5889	5317
Sire country of origin	***					
United Kingdom		125	84	1330	4134.	4027
Kenya		528	408	1042	3401	3162
Israel		76	15	667	4572	4194
Germany		269	185	1336	3964	3870
Netherlands		110	57	1051	3283	3112
USA & Canada		116	53	908	4647	4176
Southern Africa, Australia, New Zealand, not known		131	20	660	5181	3527
Age at first calving class	ns					
21-27 mo		112	38	819	4569	3379
28-32 mo		813	536	1102	3795	3452
33-38 mo		330	192	1213	3941	3577
> 38 mo		100	56	1079	4077	3768

[A] P-value: ns = not significant ; *** = significant at the level 0.0001

CONCLUSION

Although environmental factors strongly affected the LPL of Holstein cows in the 4 Kenyan herds considered, there were significant differences in survival of daughters of bulls from different countries. However, it was found that these differences in favor of offspring from foreign origins were biased by variable levels of voluntary cullings. Correcting for voluntary culling is a prerequisite for a fair comparison of Holstein-Friesian strains in Kenya. The ability

for highly productive cows to stay healthy and fertile requires the study of the effect of milk production on culling risk in all lactations. Further analyses and possibilities for the inclusion of LPL in selection criteria for sires to be used in Kenya should be encouraged.

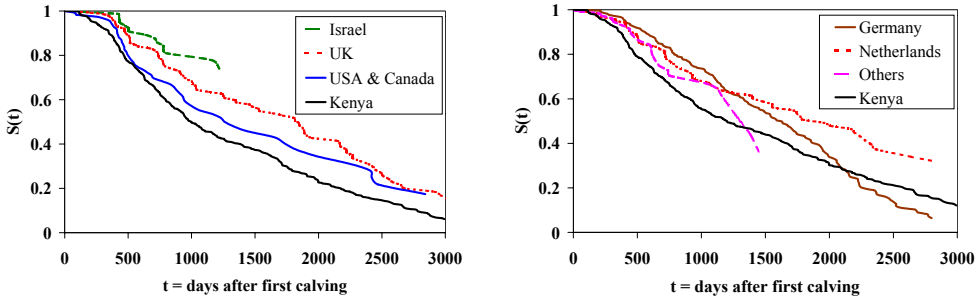

Figure 1. Kaplan-Meier estimate of survival functions for cows sired by bulls from various countries

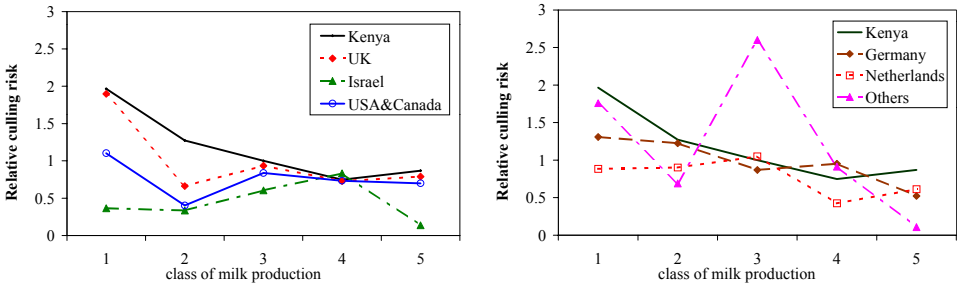

Figure 2. Estimates of the effect of class of milk production on the relative culling rate of daughters of sires from various countries

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