

## Survival of Holstein-Friesian heifers on commercial dairy farms in Kenya

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### Abstract

Herd health and adaptability are of concern in dairy herds in the tropics because of persistent exposure to multiple stresses of low quality and quantity feeding, heat stress, high disease and parasitic incidences, poor husbandry and breeding practices. The combined effect of mortality and culling is estimated to cause losses of 40 to 60% of dairy heifers conceived or born in the tropics. This study applies survival analysis techniques to evaluate important factors influencing survival to first calving in Holstein-Friesian cattle raised on large-scale farms in Kenya. On average, 25% of all the heifers born were culled prior to reaching first calving. Though the highest proportion of losses was due to unspecified reasons, the relative risk of being culled was highest when an animal had a specific disease, and survival was most critical within the first 60 days of life. Daughters of sires from South Africa and Israel tended to have better survival rates than those sired by bulls originating from other regions. When selecting sires for breeding, it is important for farmers in the tropics to consider information related to survival and fertility for stressful production systems.

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**Keywords:** Survival to first calving, dairy cattle, tropics

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### Introduction

While increasing milk production per animal in tropical dairy production systems is desirable, it is important that these improvements are accompanied by improved performance in functional and adaptive traits that are not directly related to yield but rather to specific physiological functions of an animal that decrease cost of inputs (Hoekstra *et al.*, 1994; Meuwissen *et al.*, 1995; Vollema, 1998). Functional traits include traits related to health status and disease resistance, reproduction, locomotion and survival.

Problems of herd health and adaptability are of concern in dairy herds in the tropics because of persistent exposure to multiple stresses of low quality and quantity feed, heat stress, high disease and parasitic incidences, poor husbandry and breeding practices (Ansell, 1985; Ombura *et al.*, 2007). The combined effect of mortality and culling is estimated to cause losses of 40 to 60% of female dairy cattle conceived or born in the tropics (Vaccaro, 1990). Involuntary losses of animals at any stage of their lifetime within a production system affects the overall cost of production and reduces the efficiency of output, leading to reduced profitability. Since any positive changes in functional traits leads to more profitable dairy production in all farming systems, information on the causes and effects of different environmental factors on functional traits would enable producers to make rational management decisions for increased profitability. This study was carried out to evaluate causes of mortality prior to attaining a first calving in Holstein-Friesian cattle raised on large scale farms (LSF) in Kenya, and important factors influencing survival to first calving.

### Materials and Methods

A detailed description of the data used for analyses is presented in Menjo *et al.* (2009). In brief, data was obtained from four medium to large-scale dairy farms belonging to Holstein-Friesian breeders of Kenya (LSF-1 to LSF-4), located in Nakuru district of the Rift valley province of Kenya. Animals were managed in age-based groups of calves, weaners and breeding stock. All female calves were retained and reared either as potential replacement animals or for future sale as in-calf heifers. Routine health management practices were strictly adhered to and from the age of fourteen months heifers that had attained a weight of 280 kg were served as they came into heat, with the aim of having all heifers served by eighteen months. The various farms did not regularly record reasons for culling and in many instances clear distinctions between causes for

culling were not obtainable. Mortality was considered as “involuntary culling”. Reasons recorded for culling were grouped into five categories presented in Table 1.

**Table 1** Grouping of reasons for culling prior to first calving on large scale farms in Kenya

Disposal Category	Disposal reason recorded on Farms
Dead	Slaughtered, Accident, Missing, Stolen, Blind, Fracture, Poisoning, Lameness, Died, Others
Fertility	Abortion, Difficult breeder, Dystocia, Stillbirth, Cystic Ovary, Metritis, Free martins, Premature twins
Disease	Cancer, Kidney/liver failure, Scour, Septicemia, Tick borne disease, Bloat, Pneumonia, Leptospirosis, Coccidiosis, Foot and mouth disease, Hardware
Sold	Sold to other livestock keepers
Early Loss	Dead within one week of age

Pedigree records for individual animals were compared to the official records maintained by the Kenya Stud Book of dates of birth, sire, dam and grand parents of an animal. The final dataset comprised 3508 cows, sired by 323 bulls.

Factors influencing mortality prior to first calving and the survival to first calving (S-AFC) were evaluated using survival analyses procedures (Ducrocq, 1997). All animals with an AFC were “censored” at the age of first calving as described by (Ducrocq, 1997) (however, due to AFC being at a very old age for some animals, an upper limit for AFC was set at four years of age = 1460 days). Animals that were sold prior to attaining a first calving were also “censored” on the date of sale, since the farmers policy was where possible to sell in-calf heifers to other producers for profit. For animals that died prior to attaining their first calving, their age at disposal (within 1460 days) was taken as their lifespan. If an animal had not attained an AFC by 1460 days of age, its record was “censored” at 1460 days. The distribution of lengths of life was described by the Kaplan-Meier estimate of the survival function (Kaplan & Meier, 1958).

## Results and Discussion

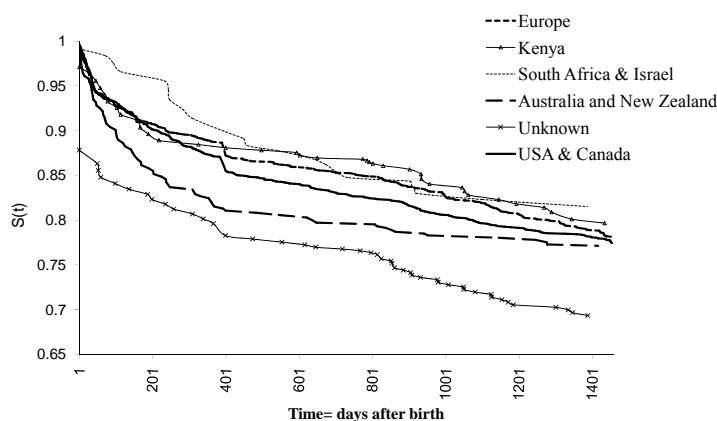
Twenty five percent of the animals born on the four farms were culled involuntarily prior to attaining a first calving. The proportionate culling due to various reasons of disposal for all animals prior to attaining a first calving is presented in Table 2. More than half of the animals culled prior to first calving in this study died without the causes of their death clearly indicated. The rate of mortality in this population was quite high for farmers who raise their own replacement animals. Identification of early predictors of length of

**Table 2** The Relative contribution of various causes to overall culling before first calving in Holstein-Friesian heifers on commercial farms in Kenya

Cause of culling	Contribution to overall culling before first calving %
Dead	68
Fertility	1
Disease	7
Sold	16
Early Loss	8

productive life is greatly valuable and potentially important in formulating breeding strategies to improve longevity of dairy cows. In most developing countries, however, systematic recording of health events is not being carried out, hence the impact of health disorders on culling can not be easily assessed. Within these environments, selection pressure tends to be severely limited by the number of animals available. It has been shown that the risk of death in dairy cattle is highest in the first two months of life, and after the sixth parity (Tarrès *et al.*, 2005). Culling rates of 40 to 60% have been reported in female dairy cattle raised in tropical environments (Vaccaro, 1990).

Fixed effects of; herd, sire region of origin and year season of birth all significantly ( $P < 0.001$ ) influenced S-AFC. The risk of an animal being culled prior to attaining a first calving differed between farms and depending on the origin of the sire. Herd effects reflect differences in management in terms of differential culling policies and animal health and general husbandry practices on the various farms. However, the interaction between herd and sire region of origin was not significant. Kaplan–Meier survivor curves for the S-AFC when stratification by sire country of origin was done are presented in Figure 2.



**Figure 1** Baseline survivor curves for animals sired by bulls from various regions.

Survivor curves stratified by sire region of origin (Figure 1) show that daughters of sires from Australia and New Zealand, and USA & Canada had lower chances of survival compared to those sired by bulls from Kenya, Europe, South Africa and Israel. The first 60 days of an animal's life were the most critical for early survival, irrespective of the origin of the sire. This concurs with results reported by earlier studies by Tarrès *et al.* (2005) and emphasizes the need for increased attention to health-care in the period prior to first calving in dairy cattle. Animals without known and verifiable records especially on origin of sire had a higher likelihood of being culled, with less than 70% of animals in this category attaining a first calving (Figure 2). However, not all such animals were discarded by the farmers since, although their sires' identities were uncertain, the farmers know that they were most likely sired by their own bulls, which are of good potential for milk production.

## Conclusion

When rearing exotic cattle in Kenya, producers tend to overlook the losses incurred early in the life of an animal, and focus mainly on milk yield obtained in an animal's lifetime as the profitability of the enterprise. A large proportion (25%) of the Holstein Friesian cattle born on the Kenyan large-scale farms was lost before reaching a productive age, indicating the limitation of such animals' adaptability to the prevailing

environmental conditions. Use of sires from heterogeneous sources without proper record keeping within the Kenyan environment is negatively impacting early survival of these animals on large-scale dairy farms in Kenya.

### **Acknowledgements**

The authors wish to acknowledge the Livestock farmers and the Kenya Livestock Breeders Organisation for availing data used in this study, and various projects and donors at the International Livestock Research Institute (ILRI, Nairobi) for provision of facilities and support to carry out the study. We also acknowledge the support and advice on use of the Survival Kit-V3.0 (Ducrocq & Sölkner, 2005) by V. Ducrocq.

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