

Longevity analysis based on virtual objective culling criteria

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Session 38.9



Introduction

Longevity of a cow is usually defined as the difference between the date of culling and the date at first calving. Culling criteria are usually subjectively applied by each farmer. However, it is possible to define longevity in an objective manner to evaluate cows for longevity including the reproductive performance of the cow.

Objectives

To use objective culling criteria by defining two virtual dates of culling for the analysis and genetic evaluation of longevity in beef cattle.

Material and Methods

1. Longevity definition and data

True length of the productive life (TL) of a cow is usually defined as the difference between the date of culling and the date at first calving. For strict reproductive longevity (SRL), a cow was assumed to be culled after having a calving interval longer than 400 days (13 months), whereas for lax reproductive longevity (LRL) a cow would be culled after having two calving intervals longer than 400 days. The database contained records from 1990 to 2008 registered in sixteen breeding herds participating in the Yield Recording Scheme of the **Bruma dels Pirineus** breed. After editing, our database included data of productive life of 2138 cows. The percentage of censored records decreased from 58% for TL to 41% and 23% for LRL and SRL respectively. The average value of longevity also decreased from 9.6 years to 6.7 and 4.4 years respectively.

2. Proportional hazards model (GDM)

$$h(t) = h_0(t) \exp \{ \mathbf{X}\beta(t) + \mathbf{Z}_1\mathbf{h} + \mathbf{Z}_2\mathbf{s} \}$$

Fixed effects (β) of parity and year effect were assumed to be time-dependent. The model was extended with the random effect of herd and the sire of the cow.

The effective heritability was

$$h_{ef}^2 = 4\sigma_s^2 / (\sigma_s^2 + \sigma_h^2 + 1)$$

The equivalent heritability was

$$h_{eq}^2 = 4\sigma_s^2 / (\sigma_s^2 + \sigma_h^2 + 1/p)$$

where p was the proportion of uncensored records

Results

Figure 1. Kaplan-Meier survival functions for true (TL), lax (LRL) and strict reproductive longevity (SRL)

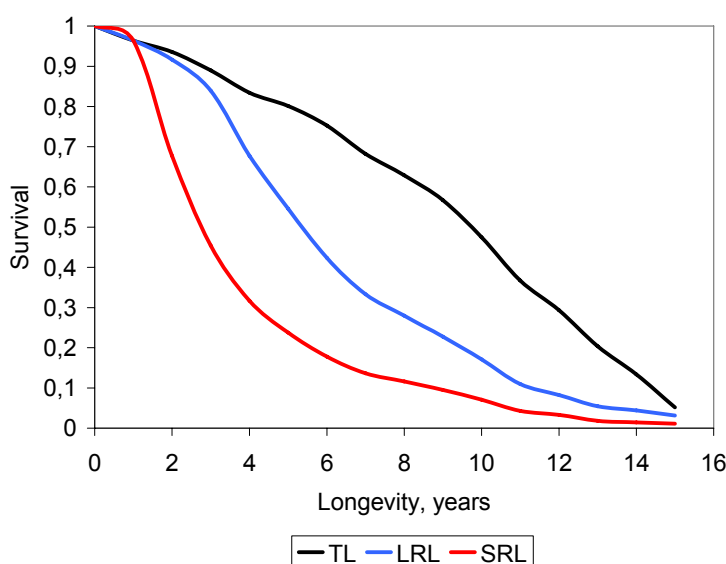


Table 1. Estimated variances and heritabilities for true (TL), lax (LRL) and strict reproductive longevity (SRL)

	TL	LRL	SRL
Censure	0.580	0.410	0.230
Herd variance	0.418	0.174	0.136
Sire variance	0.092	0.056	0.024
Effective h^2	0.243	0.182	0.082
Equivalent h^2	0.127	0.116	0.065

Conclusions

1. It is possible to define longevity in an objective manner to evaluate cows for longevity including the reproductive performance of the cow.
2. The variance of herd effect decreased using the virtual definitions of longevity due to the homogenisation of culling criteria among herds.
3. The effective and equivalent heritability decreased when reproductive performance is taken into account in longevity definition.
4. As the interest of a breeding program should be to increase the longevity of the most efficient cows, the definition of lax reproductive longevity can be a compromise between longevity heritability and reproductive efficiency.