Improving the Quality of the Genetic Evaluation for Functional Longevity in Italy

Fabiola Canavesi[1], S. Biffani[1], F. Biscarini[1]
1 – ANAFI, Cremona, Italy

Abstract

The present procedure of genetic evaluation for functional longevity was published officially in August 2001. It is based on Weibull Sire Model that make use of Survival kit as it was developed by Ducroq and Sölkner in 1998. Voluntary culling for production is accounted for in the model using 305d production classified in 5 classes based on within herd-year deviations for milk, fat and protein percent. Recent studies have shown that perhaps this is not the best way to account for production (Van Raden and Powell, 2002; Samorè *et al.,* 2003). The objective of the study was to test two alternative methods to account for production: 1) average production; 2) maximum recorded production. Results from these two alternative survival evaluations were compared with EBV resulting from the official procedure in term of risk rate for milk production resultings and correlation between longevity and production EBV. Both methods resulted in correlation closer to the value expected for functional longevity which is zero.

Introduction

Longevity is nowadays the most important traits after production in the majority of selection indices all over the world. In spite of the complexity of the trait and of the difficulties in measuring it the availability of tools like the Survival kit now allow to better estimate genetic values for this important economical trait in many countries (Vollema *et al.,* 2000; Vukasinovic *et al.,* 2001).

In Italy the present model using a Weibull Sire model is official since August 2001. The hazard function is described as the product of a baseline hazard function, depending only on time, and of an exponential function of risk factors, described by fixed and random effect, mostly generally time dependent. Fixed effect in the model are: stage of lactation within lactation number, age at first calving (time independent), year-season, 305d milk production class, fat percent production class, protein percent production class, all computed within herd-year. Random effects considered are sire and herd-year-season effects (Schneider *et al.,* 2000).

Voluntary culling for production is accounted for in the model using 305d production classified in 5 classes based on within herd-year deviations for milk, fat and protein percent.

Recent studies have shown that this approach may have some limitation. More specifically correlation with production proofs have been shown by Van Raden and Powell (2002) to be negative and between –0,27 and –0,15 which is higher than expected for direct functional longevity. Additional research by Samorè *et al.* (2003) has shown that maximum recorded production may be a better solution to account for voluntary culling in the model.

The objectives of this study were: a) to apply to August 2003 official evaluation data two alternative methods to account for milk production level within herd year: 1) average production; 2) maximum recorded production and b) to verify the impact of the two methods on ratio of risk of culling in the different production classes and on the correlation of proofs for direct longevity and production proofs.

Material and Methods

Data for the most recent August 2003 official genetic evaluation for functional longevity (Table 1) were used to test two alternative

ways to account for the effect of voluntary culling on milk production and results were compared with the official evaluation.

The model was the identical for all runs i.e. the official model as reported by Schneider (2000) except for milk production that was considered:

- within herd-year deviation of 305d milk production in the official run (OFF);
- within herd-year deviation of average daily production computed as 305d milk/DIM (AVE);
- within herd deviation of maximum recorded production (MAX).

Five classes for production were identified based on deviations from the within herd-year mean such as class 1 correspond to animals that have a production level below -1.5 SD from the mean, class two was between –1.5 and –0.5 SD, class 3 between –0.5 and +0.5 SD, class 4 between 0.5 and 1.5 SD and class 5 above 1.5 SD.

Productive life was considered as the number of days between first calving and the last known milk recording test-day. The last test-day was assumed to be the culling date because culling dates and reasons are not systematically recorded.

Sire variance was assumed known and equal to 0.021.

Risk rate for milk production levels resulting from the three models were compared and evaluated calculating the correlations between production and longevity EBV.

Table 1. Descriptive statistic of the data set used.

	N
Total number of elementary records	63,418,431
Number of cows	2,887,695
Number of sires	7890
Right censored records	799216
% censored records	27.7

Results and Discussion

In Table 2 illustrates correlations between the EBV for the direct functional longevity resulting from the two new runs and the August 2003 production proofs. Data used were restricted to national proven bulls.

The Correlation obtained with the official direct functional longevity are comparable with results reported by Van Raden in 2002 for Italian data.

The usage of average production seems to be the best method in accounting for voluntary culling due to production: almost all correlation are non significant and very close to zero.

Maximum recorded production show significant but very low correlations with milk and fat and a still high correlation with protein proofs.

The latest has no real explanation yet.

Table 2. Correlation of direct longevity proofs with production traits EBVs.

	Milk	**fat**	**protein**
OFF	-0.21**	-0,18**	-0.24**
AVE	0.006ns	0.04ns	-0.05**
MAX	-0.07**	-0.04**	-0.14**

Figure 1 reports differences in risk ratio of culling in the five production classes considered. The reference class which is set to an average culling risk of one is the average or class 3. Compared to the reference class in the official evaluation a cow that belong to class 1 has 19 times more risk of being culled than the average.

Using average production reduces this risk to 3.5 times which is comparable with other populations results (Vollema and Groen, 1998; Vukasinovic *et al.,* 1997).

Maximum production leads to a risk of culling 4.96 times higher than average for class 1.

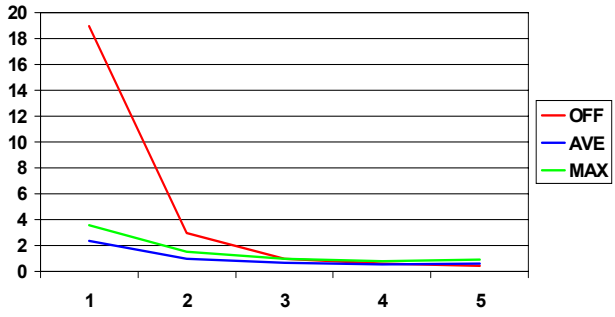

Figure 1. Risk ratio for the five classes of production.

The correlation among proofs is around 0.84-0.85 between the official functional longevity and the average and maximum production Average and maximum production direct longevity proofs have a correlation close to 0.98.

Conclusions

From this study average production seem to lead to the estimation of functional longevity proofs that have a correlation with production proofs close to the expected value of zero.

Further investigations will assess the impact of the adjustment for milk production on sire variance. Preliminary findings using maximum production to account for level of production led to an higher estimate of sire variance (Samorè *et al.,* 2003).

Additional improvement of the model will include considering a sire maternal grand sire model and the computation of pseudo animal model solution that will allow a more appropriate computation of EDC for international comparisons.

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