Proposal for recommendations on Calving traits harmonisation

The present document is intended to provide a set of recommendations for harmonising Calving traits in the framework of MACE evaluations.

Table of Contents

Introduction

One of the MACE evaluation principles is to exploit across-countries genetic correlations for a given trait. In order to get the most benefit from the evaluation, it is desirable to maintain the genetic correlations as high as possible.
The specificities of genetic evaluations performed at the national level (such as trait definition or model applied) can affect the estimation of across-countries genetic parameters.
Each country participating in MACE for a given trait is responsible for providing detailed information about the related national genetic evaluation applied using the "Interbull Genetic Evaluation form" (GE form). National GE forms are publicly available and can be accessed from the Interbull website (https://interbull.org/ib/geforms).
The investigation of the across countries genetic correlations and the following revision of the most recent national GE forms' information regarding trait definition and genetic model applied for calving traits has shown remarkable heterogeneity across countries participating in the MACE calving evaluation.
The present document aims at providing recommendations for the harmonisation of national genetic evaluations. Such recommendations have been finalised in line with existing guidelines from the International Committee for Animal Recording (ICAR).

Calving traits

The MACE evaluation considers a total of four calving traits: two traits focused on calving ease (CE), related to direct and maternal genetic effects (DCE and MCE, respectively) and two focused on stillbirth (SB), Direct and Maternal (DSB and MSB, respectively).

Traits definition

- CE is defined as "the subjective evaluation of the difficulty in delivering the *foetus* during calving (*dystocia*)". Difficult calvings lead to increased calf and cow mortality and could impair the health of the calf, the health of the dam, her subsequent fertility and her production performances.
- SB is defined as "calf mortality, shortly after birth".

Regarding the harmonisation of the traits' definitions at the national level, five different possible areas of "action" have been identified:

a) Measurement of the trait;
b) Categories of phenotyped animals used in the evaluation;
c) Data editing;
d) Evaluation model;
e) EBV scale.

a) Measurement of the trait

Calving Ease

The recommended scale for calving ease measurement consists of 5 categories related to the different levels of difficulties at calving (ICAR). Table 1 reports the categories' descriptions and related codes.

Table 1. Recommended scores for calving ease measurement.

Code	Description
1	Easy calving without assistance or unobserved birth.
2	Easy calving with some assistance.
3	Difficult calving (hard pulling, assistance by 2 or more persons, mechanical assistance).
4	Caesarean section.
5	Embryotomy.

For genetic evaluation purpose, it is recommended to combine codes 4 and 5 in a single category.

Stillbirth

The recommended scoring for collecting stillbirth data is presented in Tab. 2.

Table 2. Recommended scores for stillbirth measurement.

Code	Description
1	Calf alive.
2	Calf dead at birth.
3	Dead within 48 hours.

For genetic evaluation purpose, it is recommended to combine codes 2 and 3 in a single category.

b) Categories of phenotyped animals.

The genetic correlations estimated between the trait collected on first *vs.* later parities showed a wide range of values. In general, the correlations range from 0.60 to 0.94, being on average lower for SB than for CE and, within each trait (CE and SB), lower for maternal effects. Therefore, it is necessary to consider CE and SB proofs from first parity animals as different traits compared to the ones estimated from later parities.
As the incidence of calving difficulties and calf stillbirth is higher at first calving, and so are the related costs at the farm level, it is worth considering proofs from first parities as more informative than those from later parities.
The recommendation is to estimate proofs for CE and SB, differentiating between first vs. later calvings, and to submit only CE and SB first calving proofs to Interbull Centre for the MACE.

c) Data editing.

In order to improve the harmonisation of data across countries, the following editing on the raw phenotypes are recommended:

- Multiple birth records can increment the possibility of calving difficulties as well as of stillbirth. However, this is not related to the calving ability of the dam or the calf's ability to survive. Therefore, for genetic evaluation purposes, it is recommended to use only phenotypes from single birth events in the evaluation.
- Embryo Transfer (ET) phenotypes can be included in the evaluation if the ET treatment is properly considered: foster dam information is used to predict maternal genetic effect and estimate the maternal permanent environmental effect, while the biological dam information is used to predict direct genetic effect (Van Vleck, 1990). Ovum pick-up (OPU) and multiple ovulation for embryo transfer (MOET) periods could be fitted as effects in the model.
- Heterogeneous variance: due to the categorical definition of the calving traits, in case of adoption of a linear model it is advised to transform the data. This could be performed e.g. by applying the Snell method (1964) on the discrete CE and SB scores taking into account effects that show larger differences in frequencies for the scores (e.g. sex of the calf, number of calving and time period).

d) Evaluation model.

The use of a specific genetic model at the national level is related to each country's specificities in terms of pedigree structure and phenotypes availability. Whenever possible, CE and SB proofs meant for the international MACE evaluation should be estimated by:

- multi-trait: considering CE (first parity), CE (later parities), SB (first parity), and SB (later parities);
- animal model;
- fitting both direct and maternal genetic effects.

If at the national level the data structure prevents the possibility of applying an animal model, a Sire-MaternalGrandSire (S-MGS) model can be fitted instead. In this case, SIRE and MGS genetic effects are, by definition, predicted transmitting abilities (PTA) and denoting direct (D) and maternal (M) genetic effects with the related subscripts:

SIRE genetic effect = PTA_D
MGS genetic effect = ½ * PTA_D + PTA_M

Deriving PTA_D and PTA_M as a function of the SIRE and MGS genetic effects, the following proofs' definitions are recommended for the calving traits MACE evaluation:

- for DCE and DSB: $PTA_D = SIRE$
- for MCE and MSB: $PTA_M = MGS - ½ * SIRE$

It is also possible to submit proofs into MACE as EBV, using:

- for DCE and DSB, $EBV_D = 2 * SIRE$
- for MCE and MSB, $EBV_M = 2 * MGS - SIRE$

It is important to consider that the effective daughter contribution (EDC) for these data submissions should be consistent with these linear functions and computed using multiple-trait EDC methods (Sullivan, 2007; Sullivan et al., 2006)

Trait substitution

For some other traits evaluated in MACE, countries without a national genetic evaluation for a specific trait are allowed to submit proofs on a correlated trait, which is therefore used as a "substitute" (in calving traits, for example, a common scenario is with countries submitting DCE or MCE proofs as a predictor for DSB or MSB, respectively).
However, submitting "substitute" traits do affect negatively the across-countries correlations and therefore, do not improve the MACE evaluation results. Countries are encouraged to submit only proofs estimated for each specific trait evaluated in MACE. The habit of submitting a substitute trait should be highly discouraged for the MACE calving evaluation.

Final considerations

The recommendations presented in this document are not a prerequisite for countries in joining the Interbull MACE evaluations for calving traits. However, countries participating in the MACE evaluation are encouraged to follow these recommendations in order to improve the current level of across-countries correlations and by doing so also increasing the benefit of participating in the international evaluation for calving traits.

References

Snell, E.J. 1964. A scaling procedure for ordered categorical data. Biometrics, 20:592–607.

Sullivan, P.G. 2007. MTEDC Software Available for Standardized EDC Calculations. Interbull Bulletin 37,78-81.

Sullivan, P.G., Liu, Z. Jakobsen, J.H. & Fikse, W.F. 2006. More on weighting factors for complicated models. Interbull Bulletin 35,112-116.

Van Vleck, L. D. 1990. Alternative animal models with maternal effects and foster dams. J Anim Sci, 68:4026–4038.