



INTERBULL TECHNICAL WORKSHOP

INTERNATIONAL GENOMIC EVALUATIONS

Verona, Italy

February 2 and 3, 2012

EXECUTIVE SUMMARY

A total of 79 representatives from 25 countries gathered at the Centro Congressi Europa - Veronafiere, in Verona, Italy, to discuss the methods for international comparisons of genomic evaluations, as well as the logistics of the collaboration hosted by Interbull around this topic. The first day of the workshop focused on two main themes, international genomic evaluations and validation of genomically enhanced breeding values (GEBVs). Different approaches were combined to address the topic, including technical reports from the scientists working on method development, country reports on pilot results, a round table and thematic discussion groups. The overall result was a rich debate and fruitful exchange of suggestions and recommendations for the Interbull Steering Committee (SC). The second day brought up other important issues related to genomics, such as usage of SNPs for parentage verification, use of low and high density SNP chips, dealing with pre-selection bias and genomic reliabilities. The final session was dedicated to understand the changes expected from the introduction of a sire-dam pedigree structure in the computation of MACE EBVs. As usual in Interbull events, both the Interbull Technical Committee (ITC) and the Interbull Steering Committee (SC) had their ordinary meetings before and after the workshop. **The Interbull community expresses a very special thanks to the Veronafiere and the Associazione Nazionale Allevatori Razza Bruna Italiana (ANARB) for the excellent organization and impeccable support!**

This summary contains the highlights of the workshop discussions and most important decisions made by the SC.

INTERNATIONAL GENOMIC EVALUATIONS

- International genomic evaluation of young bulls only was proposed as an alternative to full GMACE in the 2011 Interbull Meeting in Stavanger, Norway (Sullivan et al., 2011). In this procedure, GMACE is applied to the Mendelian Sampling deviations computed as the bull's national GEBV minus his parent average from MACE ($MS_{\text{BULL}} = \text{GEBV}_{\text{NATIONAL}} - PA_{\text{MACE}}$) of young bulls individually. Due to some data inconsistencies, a new pilot study was carried out addressing the issues raised during the Stavanger meeting. 11 countries that had passed the official GEBV validation test for protein yield in August 2011 contributed with GEBVs of up to 5 traits (protein yield, somatic cell score, direct longevity, stature and cow conception rate (CC1)) in addition to national EBVs from all countries participating in the official MACE run in August 2011.
- The issues raised during the Stavanger meeting were only partly solved with the inclusion of new data in the pilot run and the International genomic evaluation of young bulls procedure as presented in Stavanger was further developed to be robust to inconsistencies such as average Mendelian Sampling different from zero and reliability of Mendelian Sampling much lower than the expectation. Further, in order to get the genomic SD to line up with the genetic sire SD, ratios between genomic standard deviations and genetic standard deviations were truncated to the interval between 0.8 and 1.2. This procedure is referred to as **"Robust GMACE of MS of young bulls" [rGM_ms(v)]**.
- The deliverables of rGM_ms(v) are conventional MACE EBVs for proven bulls and GMACE GEBVs for young bulls.

- The general understanding of the group participating in the Interbull Technical Workshop in Verona was that the results of rGM_ms(v) procedure are consistent and indicate that Interbull may be soon implementing it as the first international genomic evaluation of young bulls. In order to promote the fine-tuning of the new method, some outstanding issues still need to be addressed:
 - Establish an optimal age range for estimation of the genomic variance
 - Study the impact of different methods for estimating national genomic reliabilities or GEDCs
 - Estimate the proportion of common animals in the reference populations (C_{ij} Factor)
 - Address the case of young bulls with a sire without conventional MACE EBV
 - Investigate why some estimates for proven bulls differ from the official MACE EBVs
 - Study the consistency in proofs and reliabilities for bulls which fall into the transition period from young bull (no progeny) to progeny tested bull with only few daughters
- Some operational issues were discussed at the workshop:
 - GEBVs for all bulls older than a common threshold (e.g.12 months) should be submitted (including culled bulls)
 - Interbull should check that data files from participating countries include all animals
 - Additional information on input data:
 - Ownership of the bull
 - Bulls included in the reference population (to determine the C_{ij} factor)
 - New country-trait combinations joining the GMACE evaluations need to go through a test run
 - The GENO form needs to be reviewed to describe in more detail the national genomic evaluations
 - Which/how output should be disseminated?
 - Clearly define data access rules
 - Agree on more precise publication policies
 - Define the best timing of GMACE runs (parallel to MACE versus sequential)
- Implementation of GMACE
 - Key issues from the operational side should be worked out before the 2012 Interbull Meeting in Cork and presented at the business meeting
 - Aim for a test run in September 2012
 - Two working groups were formed by the SC to work on further development of GMACE:
 - Technical issues: Jette Jakobsen (chair), Peter Sullivan, Paul VanRaden, Zengting Liu, Gerben de Jong
 - Operational issues: Sophie Mattalia (chair), Brian Van Doormaal, Gerben de Jong, João Dürr

VALIDATION OF GEBVS

- The GEBV validation test was further investigated regarding its properties:
 - The test has definite practical justification: GEBV should predict accurately the future EBV (i.e. also the DYD)
 - In small validation populations, the statistical $SE(b1)$ seems to agree with the adopted biological significance: equivalent to approximately 500 validation bulls
 - The expected regression coefficient, $E[b1]$, is sensitive to:
 - Selection of validation bulls
 - Selective genotyping of test bulls
 - Performing the tests, compiling the data, and interpretation of results needs further harmonization between the national centres and the Interbull Centre
 - The overall conclusion is that the test works as expected and provides valid information about the validity of the national genomic evaluations
- Ways to improve genomic prediction and validation:
 - Increase genomic reference population

- Assign trait dependent residual polygenic variance or assign lower weight on G matrix
- Avoid using over-estimated bull dams in reference population or for calculating parental average
- Improve accuracy of the de-regressed conventional EBVs
- Implement a regular truncated MACE run for which countries should submit national EBVs from the current models excluding the last 4 years of data – this would provide appropriate validation inputs for countries using foreign bulls in the reference population
- SC decisions:
 - Truncated MACE runs
 - Business proposal in Cork
 - Implementation in 2013
 - Compulsory participation for all countries seeking validation of GEBVs
 - Following decision by the ICAR board, all countries that want to validate national GEBVs need to participate in the GEBV validation test starting on April 12, 2012, for all production traits (milk, fat and protein yields).
 - All countries participating in the GMACE pilot are requested to participate in the April 12, 2012, GEBV validation test also for somatic cell score, direct longevity, stature and cow conception rate (CC1). Results will be reviewed by the ITC at the Cork meeting in connection with the GMACE pilot results.
 - The participation in the planned GMACE test run in September 2012 will require validation for the same traits as for the conventional MACE run.

SIRE-DAM PEDIGREE IN MACE

- After an extensive period of testing and verification, Interbull has decided to adopt a different pedigree structure for estimation of MACE EBVs, moving from sire-maternal grandsire to a sire-dam structure, starting with the January 2012 test run and with first official evaluation in April 2012
- An extension document must be written by the Interbull Centre (with the support of Gerben de Jong) to explain the changes in the method and the consequences for the breeding industry. This document must be released for distribution by the national centres in March 1st, 2012.

OTHER TOPICS

- A proposal to change the current policy of including only national EBVs from 1986 (Holstein) or 1981 (other breeds) onwards in the MACE runs was made by the ITC. The idea is that by including also older bulls that might be included in the national reference populations it would improve consistency of national genomic evaluations. Due to the several other priorities discussed above, testing these changes will not be tested before 2013.
- A working group was formed to review the Interbull Guidelines, which are outdated: Brian Van Doormaal, Raphael Mrode and João Dürr. The goal is to have a new text by the end of 2012.
- Currently, MACE conversion equations cannot be applied for some trait-pair of countries combinations. A good example is when a country applies a threshold model and sends national EBVs in the underlying scale to Interbull, but publishes EBVs in the observed scale. The Interbull Centre will run a survey among the participating countries to identify existing problems and try to address each case in cooperation with the countries involved.
- The chair of the ICAR working group for parentage recording, Suzanne Harding, reported that the use of SNP data for parentage verification is in its final stages of testing and standardization, in a joint effort between ISAG and ICAR. The transition from the micro satellites method needs to be gradual and ways of integrating both methods are being investigated. Creation of an international SNP data repository for parentage verification purposes at Interbull is considered highly desirable.