



VALIDATION'S MODEL IN INTERBEEF EVALUATIONS EURC REPORT

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Fernando Macedo
Interbull Centre, Uppsala-Sweden

INTRODUCTION

Under all theoretical assumptions, genetic evaluations should be unbiased. However, achieving all theoretical assumptions in practice, is a complex task. For instance, the evaluation models do not include all factors affecting a trait, either because they are not all known or to maintain practicality with more simple models. Also, changes in data structure can affect the evaluation, changing our expectations. Therefore, it is important to check periodically that the genetic evaluation gives us unbiased breeding values' estimation or, in other words, it is necessary to validate the genetic model used in the evaluation.

In dairy genetic evaluation, validation is a very well-known subject. Due to an extensive use of artificial insemination (AI) and the world-level market of bulls, bias in dairy evaluations can significantly impact the industry. Given the long history of international evaluations in the dairy industry, several validation methods have been developed over the years. Example of such methods are validation methods I, II, III, IV and GEBV test (Boichard et al., 1995; Fikse et al., 2003; Mäntysaari et al., 2010) (<https://interbull.org/ib/validation>). In order to demonstrate that their procedure is unbiased, and to assure correctness of the input/output data, countries participating in the Interbull MACE evaluations must apply such tests periodically.

International evaluations for beef breeds, Interbeef, was launched in 2014 and represent still a relatively new service when compared to the MACE. Proper, ad-hoc validation methods to apply to the particular beef data structure are still under research. Even if the experience gathered from the dairy international evaluations does represent an important asset to investigate the required validation methods in beef, it is not recommended to directly apply dairy methods to beef evaluations due to the many differences between this two types of evaluations. Unlike MACE, which inputs are countries' estimated breeding values (EBVs) of A.I. bulls, Interbeef evaluations are done using animals' (both males and females) direct performances. This implies differences in

the evaluation models. Also, some peculiarities of beef cattle evaluations represent obstacles for applying some of the dairy methods. For instance, contemporary groups in beef are generally smaller than in dairy; multi-trait - multi-breed evaluations and predictor traits are more common in beef, and the maternal environment (maternal effect) has an important effect on many beef traits. Last but not least, the use of A.I. is not extensively applied in beef breeding, which leads to a lower level of connectedness among countries and fewer 'well-proven' bulls.

STATUS OF BEEF VALIDATION METHODS RESEARCH

An Interbeef Working Group was established to identify the best method to apply in beef cattle with the first task to investigate which, among the current dairy validation methods, was the most suitable method to adapt for Interbeef evaluations.

In summary, the Interbull methods and their adaptability to beef evaluations are:

1. Method I: Comparison between first vs. all lactations' genetic trends. This method was not considered suitable for beef.
2. Method II: Analysis of within yearly bull DYD. The method could be possible to apply but it should be extended to the entire progeny of the bulls.
3. Method III: Analysis of official national predicted genetic merit variation across evaluation runs. In beef, the increase in progeny across runs is limited. Therefore, although the test could be suitable for beef its application would be quite challenging.
4. Method IV. Mendelian sampling trend variation. Suitable to apply in the beef situation.

Following the advice of the Scientific Advisory Committee (SAC), it was decided to focus on investigating applicability of methods II and IV .

Method IV. Mendelian Sampling Variance test

The Mendelian sampling variance test was tested with the results of international evaluations and, at national evaluations level, with Ireland and Italy databases.

The first part of the research was devoted to finding fair criteria for identifying informative individuals to be included in the test. In dairy, the selection is done based on the reliabilities of the bulls. However, given the low number of offspring, the reliabilities in beef are rarely high. After checking different possible criteria, the group agreed to use the effective record contribution (ERC), estimated following Sullivan (2007) methodology, to select the bulls.

As the initial results were promising, it was decided to perform a small validation test: noise was introduced into the variance of the populations to check the method's behaviour. Although the method was, in some cases, able to identify the problematic models, it was deemed necessary to further investigate the applicability of the Mendelian sampling variance test including different scenarios, before any recommendations on its applicability to beef data could be made.

Method II

In recent years, countries have slowly started moving towards genomic evaluations. For this reason, it is also necessary to have an alternative method that allows to check the bias in such evaluations. Interbull method II was further investigated for this scope.

The first attempt of applying Method II (Interbull Code of Practice, Appendix III; https://interbull.org/ib/cop_appendix2) was performed using international evaluation data from the Limousine weaning weight evaluation to check the feasibility of obtaining the required information (progeny yield deviation) to perform the test. The progeny deviation was estimated with Mix99 software, and following the procedure proposed by Lidauer et al. (2005), the bull's offspring deviations were averaged per year and used as input to perform the test. Interbull Method II was applied for four countries (Switzerland, Czech Republic, Germany and Ireland), and based on the same criteria established for dairy evaluations, all the countries pass it. These preliminary results have been promising. It is expected to extend testing to more countries, breeds and traits from international evaluations data, as well as apply Method II in national data from Ireland and Italy.

FINAL CONSIDERATIONS

Considerable amount of work has been, so far, put on the investigation of suitable validation methods for beef international evaluations. However, further work is still deemed necessary to review more closely the selected methods under various scenarios and different model modifications before establishing them as reference methods for beef evaluations.

FURTHER WORK AND TIMELINE ESTIMATES

The research work to be performed can be divided into 2 parts:

1. Mendelian Sampling. Extend the tests to validate this method as a suitable method for beef evaluations.
 - a. Results are expected by the end of 2023.
2. Method II. Method II of Interbull has been tested only in international evaluations for one breed and trait. These tests should be extended to more breeds and traits as well as applied at the level of national evaluations. It is also necessary to perform validation tests to determine if the method detects evaluation problems.
 - a. The expansion to other breeds and traits at international and national level is expected to be achieved by July 2023.
 - b. Results of validation tests may be available at the beginning of 2024

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