



## “Average EBV” in Canada and “Weighted EBV” for International Evaluations - May 2001 -

### Action

Canadian Test Day Model genetic evaluations for production traits, published in Canada, are a combination of Estimated Breeding Values (EBVs) for first, second and third lactation, calculated as a *simple* average of these lactation EBVs, and can be referred to as “Average EBV”. Effective May 2001, bull proofs for milk, fat and protein yields provided by Canada to Interbull for the calculation of international MACE evaluations will be a *weighted* average of the Canadian Test Day Model proofs for first, second and third lactation. The “Weighted EBV” is calculated as the average of the lactation EBVs for first, second and third lactation, weighted for the number of daughter test day records used to compute each lactation EBV.

### Background

Since the Canadian Test Day Model considers yields in each lactation as separate but correlated traits, each bull receives an Estimated Breeding Value (EBV) for milk, fat and protein yield in each of first, second and third lactation, even if the daughters are only in first lactation. In Canada, published bull proofs most commonly used by producers are the “Average EBVs” which reflect the expected average daughter production performance across their first three lactations. This expression of domestic genetic evaluations results in a consistent interpretation of all bull proofs in Canada regardless the age of their daughters and therefore increases the stability of published bull proofs over time.

The current MACE methodology used by Interbull for computing international bull evaluations does not allow for the use of three separate lactation EBVs for each trait so a combined value must be calculated at Canadian Dairy Network and provided to Interbull. Prior to the change to using a “Weighted EBV” for each yield trait, effective May 2001, the combined evaluation for each trait has been the “Average EBV”. Although the use of “Average EBV” domestically and “Weighted EBV” for international bull evaluations results in a certain level of inconsistency in the published values, it should be recognized that there is essentially no difference between the two combined EBVs for older bulls with similar daughter numbers in all three lactations. The main difference between these two published EBVs exists for bulls that have their oldest daughters in either first or second lactation.

## Research Summary

For the past five years, researchers from the Interbull Centre as well as others in United States, Italy and Canada have been examining trends in the estimates of genetic variation over time, represented by bull birth years (1,2,3,4,5,6). Analysis of these trends have clearly indicated that there are some countries with no time trend while other countries with either an increasing or decreasing time trend. In Canada, the genetic variance estimates have shown a decreasing trend, especially for bulls born in the most recent 5-year period (4,5,6). Independent research, based on theoretical analysis of simulated data concluded that international MACE proofs for countries with a decreasing time trend, such as that found for Canada, are biased downwards, resulting in underestimation of their international ranking on other country scales (3).

More recently, research at Canadian Dairy Network compared international MACE evaluations for bulls with domestic proofs in Canada that resulted when "Average EBV" was replaced with "Weighted EBV" for Canada (6). The main effect of this modification was the removal of the decreasing trend in genetic variance estimates over time, therefore indicating an increase in accuracy via the reduction in bias of international evaluations for bulls proven in Canada. As a result, MACE evaluations for Canadian bulls are more favorable when expressed on other country scales while MACE evaluations for foreign-proven bulls generally increase when expressed on the Canadian scale.

## Scientific References

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2. Cassandro, M., F. Miglior, P. Carnier, G. Bittante, F. Canavesi, E. Santus and G. Banos, **1997**. Effect of standardisation of within country-year sire variance of deregressed proofs on international evaluations. Interbull Bulletin No. 16, pages 16-20.
3. Miglior F., K.A. Weigel and G. Banos, **1998**. Impact of heterogeneity of variance over time on international comparisons using a simulation approach. Interbull Bulletin No. 17, pages 40-45.
4. Van Doormaal, B.J., G.J. Kistemaker and P.G. Sullivan, **1999**. Heterogeneous variances of Canadian bull EBVs over time. Interbull Bulletin No. 22, pages 141-145.
5. Van Doormaal, B.J. and F. Miglior, **2000**. Trends in sire variance estimates by birth year. Interbull Bulletin No. 25, pages 70-73.
6. Miglior, F., **2001**. International bull evaluations: Effect of inclusion of Weighted EBV versus Average EBV. Presented to the Canadian Genetic Evaluation Board, April 3, 2001.

## Key Factors Considered

The following is a summary of the key points considered by the Canadian Genetic Evaluation Board (GEB) when making the decision to change from using “Average EBV” to “Weighted EBV” for international bull evaluations calculated by Interbull;

- Interbull is currently unable to utilize the individual lactation EBVs for each of milk, fat and protein yield available for all bulls in Canada, with the existing international bull evaluation system based on the MACE methodology. Although research is ongoing towards the development of an enhanced international bull evaluation system, it is estimated that official implementation would be impossible prior to 2003.
- International research has shown that bulls proven in countries with decreasing time trends in genetic variance estimates receive international evaluations on foreign country scales that are less accurate and generally biased downwards.
- Use of “Weighted EBV” for bulls with proofs in Canada, removes the decreasing time trend in genetic variance estimates that exist when “Average EBV” is used for bulls in Canada.
- Most countries involved in the international bull evaluation services provided by Interbull calculate national production proofs using 305-day lactation records rather than from a multiple-trait test day model, like that used in Canada. In these other countries, production proofs for newly proven bulls reflect only the first lactation performance of their daughters and take no consideration of expected yield performance in subsequent lactations. Therefore, the use of “Weighted EBV” from Canada results in a more consistent trait definition for newly proven bulls, regardless of their country of first proof. The fact is reflected by the trend towards higher genetic correlations between the yield traits in Canada and in other countries, as estimated by Interbull in the March 2001 test run.
- Maintaining the use of “Average EBV” as the primary proof expression domestically provides Canadian producers with some key advantages of the Canadian Test Day Model genetic evaluation system, namely the consistent trait definition for all domestically proven bulls and increased proof stability over time.
- Canadian MACE evaluations for foreign bulls will no longer reflect the expected average yield of their daughters during the first three lactations but will be more similar to the trait expression used for production traits in the country where each bull is proven.