

French Experience in Routine Validation of Interbull Evaluations

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Abstract

This paper presents different types of validations that are used in France after each routine Interbull evaluation. A large reform of the organisation of release and validation of international proofs is currently in progress, in order to increase its efficiency and to be able to detect potential problems within the two days of pre-release. Simple statistics are based on the comparison of domestic and Interbull proofs expressed on the same scale, and on the analysis of the consistency of international proofs with the previous run. They are completed by analyses of individual information on pedigrees and international IDs. The efficiency of these checks is increased by the use of clear automatic alerts. Thus proper thresholds must be defined, in order to help to detect inaccurate changes.

Interbull evaluations play a major role in the exchange of genetic material between countries, because they help users to have an objective ranking of the best bulls available worldwide. The number of countries participating routinely and the number of evaluated traits show that this work is a real success. But this leads to new difficulties: the increasing number of traits and of countries did not change the time available for Interbull for data analysis and post processing. Of course, the evaluations run much faster than ten years ago and the Interbull team is slightly bigger. Nevertheless Interbull cannot validate domestic proofs, run international evaluations and validate alone international results within 8 days. Thus the roles of the different teams (Interbull and national teams) are complementary on the subject of data validation. Problems are more likely to be detected when data are seen by different eyes! This is why Interbull sends a pre-release of international proofs and national teams are invited to check the results within two days following the pre-release, keeping all data confidential (Interbull, 2004). Such validations are even more important in a context of increasing quality requirement at all levels of our activities.

This paper presents the checks done in the routine evaluations and the evolutions that have been undertaken in the French situation.

1. French context and specificities

Five French breeds routinely participate to the international evaluations on Milk Production and on SCC (Holstein, MRY, Montbéliarde, Brown Swiss and Simmental), two for type (Holstein, Brown Swiss), two for Longevity (Holstein, Montbéliarde) and one for Calving Ease (Holstein). Thus 15 different groups of traits x breed must be checked within the first two days of pre-release of Interbull evaluations. This work is done by a unique French team at Institut de l'Elevage (2 people). The advantage is the experience and the use of the same procedures for all the breeds and traits. On the other hand, the difficulty is the reduced time to have a complete view of all the data.

Moreover, the main principle adopted since the beginning of the Interbull evaluations has been for us to give as much guarantees as possible on data quality distributed in France. Therefore procedures for validation of international proofs have been implemented very early and new tests have been regularly developed, such as tests to detect wrong IDs or pedigrees. Some of them were implemented following a “bad experience” at the international or the national level, such as removed pedigrees, changes in breed codes or in the ID used for a French bull. A lot of statistical validations are run at each release.

At this stage, the alert thresholds do not correspond to any theoretical threshold, but are determined from past experiences of normal variations and of changes due to erroneous proofs.

At each release, all the official international proofs are available on the Genetic Information System (Système d'Information Génétique, or SIG) which includes all the data used in animal breeding. In addition to proofs, all the information related to the bulls is included in the SIG: birth date, name, original ID, pedigree, breed codes... On this basis, any French breeding or milk recording organisation, any AI company can use at the same time the same official information and people receive as much information as possible on the available foreign bulls. This is one of the reasons why the checks on international results are not only relative to EBVs but also to other information (pedigree, birth year, breed codes).

In France, the whole French animal breeding system (identification, recording of pedigree and performances, AI, genetic evaluations) is presently working on the implementation of quality management system (Gastinel *et al.*, 2005). In this context, a large reform of the organisation of release and validation of international proofs is currently in progress, in order to better describe the procedures, to harmonise them and to generate automatic alerts. Indeed, the checklists were previously too numerous and too heterogeneous between traits and breeds and they did not lead to a usable summary of the main alerts at the end of each program. Therefore, the produced statistics could not guarantee a serious and systematic analysis and only trained people having a long experience could efficiently detect problems among the large amount of information available. Moreover, the same program was used to validate proofs and to pre-process the data that were included in the SIG. For Milk production, there were as many programs as breeds because breed specificities (publication rules checks of breed codes...) were treated at this level. With the new procedures, in a first step, a program of validation is used for all breeds together. In a second step, files are created to

update the SIG and breed specificities are taken into account. Checklists are simplified and a final file is created for each breed x trait, which summarises all the alerts.

2. Description of data validation steps made routinely in France

2.1 Checks on bulls information delivered by Interbull for bulls without French daughters (breed, birth year, pedigree)

At each release, information on bulls is compared to the last evaluation. Lists are made with bulls meeting one of the following characteristics:

- IDs disappearing from one evaluation to the next
- Bulls present for the first time with more than 200 daughters
- Bulls present for the first time and at least 10 years old
- Bulls with changing pedigree information

In each case, a table giving the number of bulls by country with most daughters is indicated. Interbull is alerted if there are an unusual number of bulls on one of these lists. An additional list indicates duplicate bulls with Interbull evaluations, when the breed code is not taken into account in the ID. A few bulls are detected here and they all correspond to actual duplicates, whose breed codes sent by two countries are not the same (RED/HOL, RED/MON or MON/SIM).

The purposes of such validations are:

- To detect real changes in pedigrees and to update the SIG
- To detect inaccurate and massive changes in pedigrees or removal of information in one particular country, that could affect the proofs of the whole population of the country.
- To avoid the creation of new IDs of foreign bulls already known in the SIG with another ID, particularly when the bulls are already used in France.

2.2 Checks on bulls with French daughters taken into account in Interbull evaluations

At each Interbull evaluation, we verify whether all the bulls that should have been taken into account by Interbull, according to the birth year, the status of the bulls and of their proofs, were actually included in the evaluations. French bulls whose inclusion in the Interbull evaluation is not understood are also detected. At the beginning of Interbull evaluations, these checklists helped to detect wrong IDs used in France for foreign bulls with French second crop daughters. Now, Interbull cross reference lists and pedigree files are a very useful tool to correct wrong ID very early. More recently, only very few problems were detected at this step of validation. The most recent cases were corresponding to bulls abnormally included in the Interbull evaluations, because of a wrong the birth date sent to Interbull by the country of birth.

Moreover pedigrees of French bulls sent in the 010 files are compared to pedigrees used by Interbull. The purpose is to detect wrong pedigrees of French bulls, which could affect the Interbull proofs of these bulls in other scales.

2.3 Checks on consistency between domestic and international proofs (bulls with French daughters)

For each trait x breed, the consistency between domestic and international proofs expressed in French units is assessed. French domestic proofs are expected to be highly consistent with Interbull proofs, particularly when the

bulls have only French progeny. This is why proofs correlations, average differences, differences between proofs standard deviations are computed for different sets of bulls:

- Foreign bulls with French second crop daughters
- Bulls progeny tested in France and with foreign daughters
- Bulls with only French daughters.

The routine statistics are computed for bulls with a good reliability on domestic proofs (at least 70%, which corresponds to the minimum requirement for the publication production or type EBVs). The thresholds for alerts on the third group are of course much more severe than for the first or the second one. In Montbéliarde and Holstein breeds, where most of the bulls are progeny tested in France, we expect proofs correlations of at least 0.995, less than 1% of difference between means and between proofs standards deviations, when these differences are expressed in genetic standard deviation.

Tables 1 and 2 give statistics obtained on all milk production and for longevity (Holstein) in February 2006. Even for small breeds and for traits with a very low heritability, the produced statistics show that the consistency between domestic and international EBVs is expected to be almost perfect. Thus simple and useful alerts can be produced from the comparison of domestic and international proofs expressed in the same units. Such statistics can help for instance to detect any problem in the estimation of the country effect, in the de-regression or in the re-standardization of the final proofs.

Table 1. Comparison of French domestic proofs and international EBVs expressed in French units (data from Feb. 06): Production traits (Milk, Fat and Prot. Yields).

Type of bulls	Breed	Nb Bulls	Correlations	Average difference (domestic-ITB) in % of σ_g	Difference between proofs stds (domestic-ITB) in % of σ_g
only French daughters	Holstein	8532	>0.999	-0.39 to -0.32	0.05 to 0.40
	MRY	58	0.978 to 0.983	0.73 to 1.13	-0.25 to 4.46
	BSW	88	>0.999	-2.12 to -2.06	0.71 to 1.41
	MON	2284	>0.999	-0.15 to -0.35	-0.36 to 0.07
	SIM	140	0.999	-0.09 to +0.59	+0.42 to +0.56
Foreign bulls with 2 nd crop daughters	HOL	266	0.996 to 0.997	+1.03 to +1.85	+0.85 to +1.43
	MRY	16	0.775 to 0.877	-3.94 to +6.13	-26.5 to -12.6
	BSW	59	0.980 to 0.983	+2.33 to +2.63	+2.24 to +3.91
	SIM	42	0.985 to 0.991	-0.91 to +1.04	-6.43 to -5.28

Table 2. comparison of French domestic proofs and international EBVs expressed in French units (data from Feb. 06): Longevity, Holstein.

Type of bulls	Nb Bulls	Correlation	Average difference (domestic-ITB) in % of σ_g	Difference between proofs stds (domestic-ITB) in % of σ_g
only French daughters	3785	0.998	-0.01	+0.01
Foreign bulls with 2 nd crop daughters	221	0.983	-1.3	-1.3

2.4 Checks on consistency between two releases (foreign bulls without French daughters)

For each trait x breed, bulls that were already included at the previous routine evaluation are used to check the consistency of Interbull proofs (expressed on the French scale) between releases. Statistics are computed by country with most daughters. Proofs correlations are checked; average EBVs and proofs standard deviations are compared between releases. Countries with proofs correlations lower than .99 (0.98 for longevity) or with a difference between proofs average (possibly corrected for the French yearly base change) of more than 5%, or with a difference between proofs standard deviations of more than 5% are listed. For well connected countries with a large population size, the proofs variations are much smaller (lower than 2% for instance for USA,

Canada, Italy, Germany and the Netherlands when proofs are expressed on the French Holstein basis). Past experience showed that lower correlations or higher average differences were always due to some changes either in the national, or in the international procedures of evaluation. Variations higher than the threshold are accepted when the new evaluation includes a large amount of new information (if the previous release was at least 6 months old for instance) or in case of change in model in the country with most daughters. In case of doubt Interbull is informed.

During the analysis of test runs, such statistics are very useful to identify the most important changes among all the changes announced by Interbull: a lot of changes are minor and they only have reduced consequences on the final results.

3. Conclusion: Discussion on the efficiency of these tests

This strategy showed several times its efficiency. For instance, it helped to detect an error in the Interbull type proofs expressed in French units in November 2005 (high average differences between domestic and international proofs and unusual average variations by country with most daughters), a problem in the Interbull proofs in Montbeliarde breed in February 2005 and in some pedigrees sent by a country to Interbull in May 2005. Unfortunately, because of the former heavy organisation described in the first part of this paper, some of the problems were detected too late, ie, after the pre-release of Interbull proofs. This is why it is very important to produce complete and clear checklists and alerts for each evaluation.

Statistics must be combined together for a better efficiency: the proofs correlations, for instance, must be considered as one indicator of problems among others. For instance, in February 2005, about 50% of the connections between France (Montbéliarde) and foreign countries were removed because of a mistake in the international cross reference table. The correlation between French domestic and international proofs was very high (>0.995), the averages and standard deviations of proofs of French bull were not affected by the problem. The proofs correlations between releases were perfect for foreign bulls. Only the fact that the international average differences were higher than usual could be an alert: due to the error, international proofs increased by 11 to 16% depending on the trait and on the country with most daughters and all the differences were in the same direction. At the same time, the Interbull EBVs expressed on the French Simmental basis, that used the same bulls, was not affected by the mistake, because Montbeliard bulls do not connect with the French Simmental population. This shows that looking at only one list expressed in on particular scale is not sufficient and that one problem can affect one Interbull ranking and not the others.

The difficult point is the proper threshold definition. Past experiences often showed that the thresholds could be very severe (correlations between domestic and international proofs >0.99 for instance).

Other kinds of validation could be developed at the international level. For instance at each Interbull evaluation, the number of common bulls between two countries (indicated on the Interbull web site) can be used for a check in order to detect abnormally removed connections between two countries: the number of common bulls should be at least constant between two runs. It could also be interesting to communicate to Interbull more information on national changes, such as the expected decrease in proofs due to a change in basis, even when these changes do not affect the international rankings, in order to give Interbull more tools to validate the results. Some of the checks that are described in this paper may be redundant with checks done at the Interbull level, or may complete them. Thus national teams and Interbull should know exactly what kind of check is relevant to each level.

Finally, these analyses must only be considered as a routine validation. Many of the checklists are based on the comparison with the last release and they assume that the previous evaluation was correct. Wrong genetic correlations, for instance, cannot be identified by these checks. This is why additional studies must be regularly undertaken, such as the analysis of proofs of bulls with daughters in two countries. For instance, an interesting tool is the comparison of conversion formulae obtained on one hand by using classical methodology on common bulls (Wilmink's or Goddard's methods) and on the other hand by deriving coefficients from MACE results. Such studies need the exchange of domestic proofs between countries and all the collaborations, preliminary studies on domestic proofs are very important steps for an efficient validation of the international evaluations.

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