Interbull Centre Report

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Introduction

Since the last annual meeting in Rotorua, New Zealand, January 1998, Interbull activities have increased considerably as per decisions taken at that meeting and results presented at the workshop in Cremona, Italy, October 1998. Quarterly routine evaluations for production and conformation evaluations have been introduced. Research and development activities have expanded both in-house and in collaboration with different research groups worldwide. Higher service fees decided upon in 1998, an EU contribution and greatly appreciated external research grants supported our increased activities. In the following more details are reported in the various areas of work.

Production trait evaluation

As of November 1998, the frequency of Interbull genetic evaluations for production traits increased from two to four times per year. Such evaluations are now being computed each February, May, August and November. Intermediate test-runs are conducted in March and September. The same scheme is now also applied for Holstein conformation evaluation.

In 1998 a new improved method to estimate the reliability of international genetic evaluations was introduced, based on scientific work at the Livestock Improvement, New Zealand.

Some major changes also took place in individual country national evaluations during the past year, including the introduction of test-day model genetic evaluations in Germany and Canada and across-breed genetic evaluation in Australia. The impact of these changes on Interbull evaluations was examined in separate test-runs whose results were reviewed by representatives of all participating countries.

Among the numerous minor changes that have taken place during the year, is worth mentioning the changes in individual animal identification systems that have been implemented in Switzerland and the Netherlands. The former was taken care of without much difficulty, while the latter introduced more problems. The need for early information from exporting countries and responsiveness in importing countries, before such changes are introduced, has increased with the increased exchange of genetic material, and can not be overemphasised.

August 1999 evaluation

August 1999 marked the completion of the 13th Interbull evaluation for production traits. Currently 24 countries subscribe to the service; the last country to join was Hungary. Participation level has increased since the launch of the service (August 1994) as shown in Fig. 1.

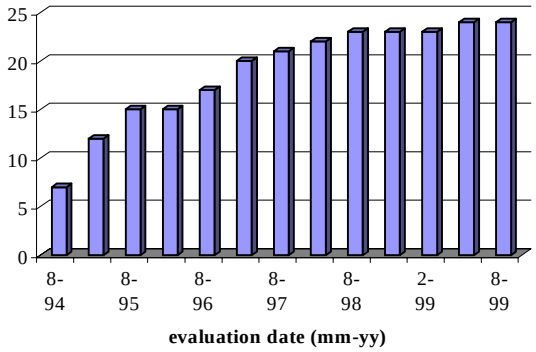

Figure 1. Number of countries subscribing to Interbull services.

Number of populations and bulls has also increased substantially. In the first Interbull international evaluation 16,104 bulls from 2 breeds (Ayrshire and Holstein) and 4 populations

were included, while the total number of bulls included in the latest routine evaluation was more than 100,000 (Table 1).

Table 1. Data included in the August 1999 Interbull evaluation for production traits

Breed	No. of bull populations	No. of Bulls
Ayrshire	8	8,865
Brown Swiss	10	6,707
Guernsey	4	727
Holstein	23	58,292
Jersey	7	5,255
Simmental	8	20,880

Publication policies

In the early days of Interbull genetic evaluations, proofs were not regarded as official in all countries. We have, however, seen an increasing international acceptance as a result of communication efforts and the continuous improvement of international, and national, methods and data quality. Thus, the results of the latest routine evaluation for production traits were regarded as official in almost all countries (Table 2).

Table 2. National policies regarding use of Interbull (ITB) evaluations for dairy production traits by breed of evaluation

	No. populations with ITB proofs:		
Breed	official	official, rel.res.[a]	unofficial
Ayrshire	5	3	0
Brown Swiss	3	7	0
Guernsey	2	2	0
Holstein	5	16	1
Jersey	3	4	0
Simmental	3	5	0

[a]Restrictions based on reliability or similar

The national policies regarding use of Interbull evaluations are, however, usually subject to restrictions based on e.g. national and international reliabilities. Commonly, Interbull evaluations are official for foreign bulls, unless national proofs with a minimum reliability are available. The "reliability threshold" varies considerably, or from 60% to 95%. Detailed information can be found on the homepage of Interbull at http://www-interbull.slu.se.

Conformation evaluation

On March 22, 1999, the Interbull Centre announced to all members the launch of a new international genetic evaluation service for conformation traits for the Holstein breed. The decision to launch this service was partly based on discussions at an Interbull workshop (Italy, October 1998) where scientists from several institutes worldwide presented the most recent findings in this area.

Adding a large number of new traits to the service portfolio of Interbull would certainly increase the operational load. In order to alleviate this problem and use its resources efficiently, Interbull decided to source numerical computations outside the Interbull Centre. Following a call for tenders in December 1998, Interbull finalised an agreement with a group of four North American organisations: Holstein Association USA, National Association of Animal Breeders (NAAB), Holstein Canada and Canadian Dairy Network (CDN).

The contract declares that the subcontractor performs specific computer demanding numerical calculations, which are part of the whole evaluation process, but does not offer genetic evaluation services on behalf of Interbull. The evaluations will be an integral part of the Interbull service under the full responsibility and control of the Interbull Steering Committee. In the first instance, Interbull considers this a project, whose merits will be reviewed after two years, and that will be overseen by a technical committee.

May 1999 test-run

The first test-run was conducted in May 1999, based on data submitted from 14 bull populations in 13 countries. Seventeen traits were included in the evaluation: stature, chest width, body dept,

angularity, rump angle, rump width, rear leg set, foot angle, fore udder, rear udder height, udder support, udder depth, teat placement, teat length, overall conformation, overall udder, and overall feet & legs.

With 14 bull populations and 17 traits, estimating genetic correlations became an enormous task, and proved also to cause major problems. Mainly due to lack of data connectedness, possibly remaining differences in trait definition, and methodological issues, some estimates converged to very low, unrealistic values. These problems could not be sorted out during the test-run and it was finally decided to exclude four populations from the evaluation, and to continue to work on solutions to the problem.

Results from the test-run were distributed to all participating countries and the technical committee for review. They were generally well accepted and were along the lines of results from earlier research and pilot studies, although (minor) misrepresentations of some bulls and the problems of low correlations were identified.

Routine evaluation

The very first routine Interbull genetic evaluation for Holstein conformation took place in August 1999, and results were distributed to 15 countries subscribing to this service on August 9. The evaluation included bulls from 10 countries, with a varying number of bulls depending on trait (Table 3).

Table 3. Number of national bull evaluations submitted for the Interbull evaluation for Holstein conformation traits[a] (August 1999)

Country	Trait	
	Stature	Overall feet & legs
Australia	1837	0
Canada	4270	4270
Denmark	3282	3281
France	7712	4655
Germany	5135	1866
Italy	3038	0
Netherlands	4960	4951
Spain	527	514
UK	1437	826
USA	13937	13937
All	46135	34300

[a]Traits with most and least number of observations given as example.

Total number of publishable proofs was 4-5% lower than number of submitted individual national evaluations, mostly due to common bulls with proofs in more than one country. The corresponding figure for Holstein production traits usually is 9-10%, thus indicating more simultaneously evaluated bulls for those traits.
Correlations between national and international evaluations were in the range from 0.98 to 1.00, with most close to unity. The same holds true for the corresponding figures for production traits, although occasionally lower numbers can be found.

Genetic correlation estimation procedure for production traits

A major advantage of MACE (Multiple Across Country Evaluations) over conversion formulas is that it allows re-ranking of bulls between countries. This does, however, require estimates of the genetic correlations among bull populations. With an increasing number of populations, this process becomes increasingly difficult and time consuming. Estimation of genetic correlations among countries therefore takes place in test-runs only, when new or modified data are submitted from a country. The following procedure, established at the Interbull technical workshop of April 1995, Uppsala, Sweden, is applied:

Step 1: Several subsets of countries are analysed. At the most 10 countries at a time are included in each subset. Countries that are major link contributors (judged from the number and origin of common bulls with multiple national evaluations) are always included in these subsets. If multiple genetic correlation estimates are computed for a country pair, the highest estimate is kept, as per Sigurdsson et al. (1996) showing that genetic correlations may be under-estimated but not over-estimated by the method used.

Step 2: In some cases sufficient links between countries may be missing, resulting in close to zero genetic correlation estimates. If no reasonable correlations can be estimated via indirect links with third countries, one the following procedures is followed:

a) Estimates from another breed for the country pair are used, if applicable.
b) Product moment correlations of common bulls, adjusted for national evaluation accuracy are used (not a very frequent practice, since presence of common bulls will likely result in reasonable correlation estimates using the approximate REML method of Sigurdsson et al. 1996).
c) Estimates from the low end of the correlation distribution are assigned based on prior information such as model of national evaluation, known correlations with third countries and geographic variables. These would normally range from 0.86 to 0.89 between two North hemisphere countries and from 0.75 to 0.78 between a North and a South hemisphere country; countries with similar national evaluation models and/or high known correlations with third countries are normally assigned higher genetic correlation estimates.

Step 3: Since genetic correlation estimates are not derived simultaneously, the full covariance matrix need to be bent in order to ensure it is positive definite; bending applies to estimates from Step 2 only.

Table 4 shows the range of genetic correlation estimates between groups of countries.

Table 4. Genetic correlation ranges in Interbull genetic evaluations for dairy production traits

Group of countries	Genetic correlation
Northern hemisphere countries (group 1)	0.85-0.96
Australia and New Zealand (group 2)	0.89-0.90
Between group 1 and 2	0.75-0.84

Efforts to improve the procedure are currently under way, for instance by using covariance functions. If a country is not linked to the other countries in the evaluation system, its data are not included in the international genetic evaluation.

Research activities

Research at the Interbull Centre is conducted mainly by Dr. Hossein Jorjani and Mr. Freddy Fikse, frequently in collaboration with other institutes worldwide. The aim is to improve the international genetic evaluation service. Current and planned research activities at the Interbull Centre falls under two categories:

A. Improvement of existing methods for international evaluation (current activities):

- Optimal weights of daughter information; at present the total number of a bull's daughters is used; alternative weighing factors are being investigated in simulation studies.
- Data connectedness and genetic correlation estimation based on national breeding values; an algorithm is being developed to investigate connectedness of different data structures; the algorithm may help identify informative data for genetic correlation estimation.
- Incoming data quality control including a new survey of national genetic evaluation systems; a detailed questionnaire was designed and distributed in April 1999; compilation of responses commenced in June 1999.

B. Development of new methods for international evaluation based on individual animal records (planned activities):
   - Comparison with current system; a simulation study is designed to investigate the benefits of an international animal model over MACE; different models for national and international genetic evaluation will be considered.
   - Genetic parameter estimation; the aim is to develop appropriate methods and definitions; properties of the estimators will be investigated with simulation studies.
   - Field data analysis following simulation study results.

In addition, trait-specific research is taking place in various institutes paving the way to new international genetic evaluation services for other economically important traits:

Conformation traits: Research has been conducted at institutes in the US, Canada, Germany and the Netherlands. As per 1999, Interbull is offering international evaluation services for conformation traits. Continuing research aims at further improving the service.

Somatic cell count: Joint research between the Agricultural Universities of Sweden and Denmark is investigating the feasibility of international genetic evaluations.

Publications

The following Interbull-related publications were produced in 1998/1999:

Interbull Bulletin No. 17. Proceedings of the 1998 Interbull Meeting, Rotorua, New Zealand.

Interbull Bulletin No. 18. Proceedings of the International Workshop on GIFT; Fertility and Reproduction, Grub, Germany.

Interbull Bulletin No. 19. Proceedings of the Intermediate Report Workshop EU Concerted Action GIFT, Warsaw, Poland.

Interbull Bulletin No. 20. Proceedings of the Computational Cattle Breeding '99 Workshop Tuusula, Finland.

Interbull Bulletin No. 21. Proceedings of the International Workshop on GIFT; Longevity, Jouy-en-Josas, France.

Interbulletin, The Newsletter of Interbull, June 1999.

G. Banos. 1998. "Review of international genetic evaluation procedures in dairy cattle" Anim. Breed. Abstr. 66, 585.

J. Philipsson. 1998. "Global use of bulls and the INTERBULL system". Acta Agric. Scand., Sect. A, Animal Sci. Suppl. 29, 98-107.

B.W. Wickham & G. Banos.1998. "Impact of international evaluations on dairy cattle breeding programmes" Proc. 6th World Congress on Genetics Applied to Livestock Production. 23, 315.

G.W. Rogers, G. Banos & U. Sander Nielsen. 1998. "Correlations among US traits and calving traits in Denmark and Sweden" J. Dairy Sci. 81 (Suppl. 1).

G.W. Rogers, G. Banos, U. Sander Nielsen & J. Philipsson.1998. "Genetic correlations among somatic cell score, productive life, and type traits from the United States and udder health measures from Denmark and Sweden" J.

Dairy Sci. 81, 1445.

W.F. Fikse & G. Banos. 1999. “Weighting factors of daughter information in international genetic evaluation for milk production traits: effect on (co) variance components”. J. Dairy Sci. 82, 72 (Suppl. 1).

G.W. Rogers, G. Banos & U. Sander Nielsen. 1999. "Genetic correlations among protein yield, productive life, and type traits from the United States and diseases other than mastitis from Denmark and Sweden" J. Dairy Sci. 82, 1331, 1338.

The following presentations were made by Interbull staff in 1998/1999:

J. Philipsson. “Guernsey Global Breeding Plan”. 9th World Guernsey Conference, Louisville, Kentucky, USA, March 1998.

G. Banos "Can international genetic evaluations enhance genetic progress in an individual country" National Dairy Genetics Workshop. Orlando, Florida, USA, April 1998.

J.Philipsson. “Use of Interbull information in genetic evaluation of sires - global strategies and recommendations for Poland”. Workshop Jastrzebiec, Poland, October 1998.

G. Banos "Importance of uniform international criteria in genetic evaluation” International Symposium on the Future of Dairy Cattle. Povoa de Varzim, Portugal, November 1998.

G. Banos “International genetic evaluations for production and type for the Red & White breed”. European Congress Red & White Cattle. Agerskov, Denmark April 1999.

G. Banos “Recent developments in international genetic evaluations; emphasis on conformation traits”. 24th European Holstein Conference. Charmey, Switzerland April 1999.

U. Emanuelson “Impact of national evaluation models on international comparisons” Computational Cattle Breeding ’99 Workshop Tuusula, Finland, March 1999.

F. Fikse. “Weighting factors of daughter information in international genetic evaluation for milk production traits: effect on (co) variance components” ADSA annual meeting, Memphis, TN, USA, June 1999.

References

Sigurdsson, A., Banos, G. & Philipsson, J. 1996. Estimation of genetic (co)variance components for international evaluation of dairy bulls. Acta Agric. Scand., Sect. A, Animal Sci. 46, 129-136.