An Essay on Interbull Evaluations from an AI-Industry Perspective

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Introduction

About ten years ago Schaeffer (1994) introduced MACE as a method for Multiple-country comparison of dairy sires. The two key issues of MACE are that breeding values from different countries are modelled as different traits, and that DYD's or deregressed proofs are used as data. Important issues that were raised by Schaeffer are: the importance of genetic groups, connectedness, the role of preferential treatment, unique identification, estimation of variances when using DYD's as data. Also, Schaeffer observer that "the multiple-country model may be most applicable to conformation traits that are not measured or scored in the same manner in each country, and, therefore, the genetic correlation between countries may be low or negative". This remark by Schaeffer is especially interesting in light of the discussions going on the last year in the international breeding literature.

In later studies (Schaeffer *et al.*, 1996; Siggurdson and Banos, 1995; Banos and Siggurdsson, 1996) deregression procedures and methods to estimate sire variances and correlations from deregressed proofs were described. In the last ten years, International Evaluation procedures have steadily improved. There are now 30 Interbull bulletins published including several hundreds or maybe even more than thousand pages on international evaluation procedures. Interbull now routinely evaluates international proofs for production, somatic cell score and conformation. The introduction of Interbull evaluations for longevity and calving traits is a matter of time.

So, when you judge the quality and quantity of Interbull evaluations, you can only conclude that impressive progress has been made in the last decade.

The aim of this essay is to point out that there is a contrast between the development described above and the feeling and ideas about international evaluations that are widespread within the global AI industry. This essay will outline trends in the industry, give examples of problems, and will discuss ideas on how to improve international evaluation.

Trends in the marketing of dairy bulls

The AI industry worries about international genetic evaluations. Several representatives of the AI industry have expressed their concern in the international professional breeding literature. A result of this concern is that, more and more, AI companies market their bulls using domestic proofs. Holland Genetics, for instance, uses Dutch proofs for conformation in the German market.

Another trend in marketing of dairy bulls is that breeding values, be it domestic proofs or international proofs, are not used at all in the marketing of bulls. This is most likely linked to both the explosion in the number of traits for which breeding values are available, and to the concerns about international breeding values. In the last issue of the Veeteelt magazine there was one international famous bull promoted and the only number in the add was the phenotypic score for conformation of the bull himself!

Trends in breeding

When Interbull started, international Holstein breeding was still pretty straightforward. Breeding was for protein, udder and feet&legs, with a clear dominance for the trait protein. Breeding companies world-wide more or less used the same mating sires because they all selected for the same trait that was highly

correlated among countries. Since then, the number of traits for which breeding values are computed has steadily increased. In many countries, breeding values are now available for longevity, udder health, female fertility and calving traits. Total merit indices have been introduced or have been redefined to include more longevity and health traits. Simultaneously, breeding organisations have adapted their breeding goals and now select more strongly for longevity and health traits. This is a global trend. So breeding organisations have changed their breeding goals, but all in the same direction. The breeding goals are as similar as they were ten years ago. However, the mating sires breeding organisations use are much more diverse than ten years ago. Breeding organisations now much more often use domestic bulls. An important reason for this is that the correlation between the total merit indices of countries is much lower than the correlation between kgs of protein ten years ago. In short: breeding organisations have the same breeding goal but much more than ten years ago use different selection criteria to achieve that goal.

Trends in the dairy industry

Above, I observed that the correlation between selection criteria has dropped among countries. In the same time period, international farming conditions became more alike. For most countries the modern and future dairy farm is a large unit in which labour needs to be used efficiently, cows are housed in free stall barns with less grazing, with diets that are alike. Dairy farmers are internationally oriented, are not afraid to adapt farming practices from other countries or the emigrate to other countries. All those farmers ask for a trouble-free cow that produces efficiently in this environment that becomes more and more alike.

At the same time that the major farm type becomes more alike world wide, we see within most countries that the distinction between high-input and low-input systems becomes clearer, and more recognised.

As observed in several studies there is a clear need for breeding value estimation that is based on production systems, and not on country barriers.

Example: the Holland Genetics Index

At Holland Genetics we use an index to quantify our breeding goal. Using the Dutch breeding values and the index weights we make a Dutch ranking of bulls. Using US breeding values and using the same index weights (corrected for scale and variance differences) we also make a US ranking of bulls. The differences between the Dutch ranking and the US ranking are remarkable, and make life of a breeder interesting. Table 1 lists the top 10 bulls based on the US ranking and the top 10 bulls based on the Dutch ranking. You see that Bull C ranks number 3 based on US data, and only number 780 based on Dutch data. Bull R is number 18 on the Dutch list, and only number 1092 on the US list. We use bull R as a mating sire but have difficulties explaining this to our international customers who are largely focussed on the US index lists. As an international breeding organisation we need to recognise that neither the US ranking or the Dutch ranking is correct. It is quite possible, for instance, that many of our Dutch customers are happier with the US definition of a good udder, than the Dutch definition of a good udder. So we need to make a balanced decision based on the available rankings.

Example: information the international genetic model does not exploit

To evaluate our breeding programme we often use 2, 3, 4 or five generation pedigree indices. From analysing those indices we also have learned that five generation pedigree indices can contain much more information than, for instance 2 generation pedigree indices. In Table 2 the results of a comparison between 2 and 5 generation pedigree indices are given. The difference is defined as:

PIDIF = IDDS/8+IDDDS/16+IDDDDS/32

where IDDS is index of the sire of the dams dam, IDDDS is the index of the sire of the dam of the dam of the dam, and IDDDDS is the index of the sire of the dam of the dam of the dam of the dam.

PIDIF basically is an estimate of the contribution of the granddam to a bull. Because Interbull uses a sire – maternal grandsire model with genetic groups, this is the part in the interbull evaluation that is to be picked up by the genetic groups. Table 2 lists the number of bulls from the HG breeding programme per class of PIDIF against year of birth of the granddam. Only bulls with a Holstein granddam from the US are taken into account. Table 2 shows that within a genetic group as it is defined in the Interbull model, there is a wealth of hidden information. For most years of birth, the difference between the highest and lowest PIDIF is in the order of 20 Euro INET, or more than 0.2 standard deviation units. This is easy to obtain information that should be exploited in International evaluations, but currently isn't.

The importance of Cow families

The study of De Jong (2003) points to an interesting difference between the genetic model for international evaluations and the reality of international breeding. The genetic model ignores cow families. In practice cow families and bull dams more and more get widespread international use. De Jong showed that more than 20% of the bulls are from cows that have more than 5 sons. The extreme was a cow having 43 sons. And usually, the more popular bull dams have sons in several countries providing connectedness that is not yet exploited.

Discussion

Breeding decisions are nowadays less based on the information from international evaluations than a few years ago. The reasons for this are that in the breeding goals traits are included for which correlations between countries are either low, or for which international evaluations are absent. In addition, marketing of bull is less based on international evaluations. In the AI industry there is a growing concern about the consistency and credibility of international evaluations. In contrast to this concern, one can observe that the quality and quantity of Interbull evaluations has improved. This is a discrepancy that should be explored. I think the following factors determine this discrepancy:

- The demand for more and better international evaluations has grown more rapidly than the supply of it.
- There is a growing demand for international standards and stable global ranking. The breeding industry is international. Farmers are internationally oriented. If two farmers of two different countries discuss about the cow they want, then they tend to agree. So those farmers do not understand why bull rankings differ so much among countries.
- There is lack of clarity about how Interbull operates, how international evaluations are computed, about the responsibilities of national evaluation centres and Interbull. There is also need for more and more detailed information about the behaviour of the international evaluations of individual bulls.

How to reduce the discrepancy? I suggest the following points:

- Interbull should not only be a service organisation for national evaluation centres, but also for the international breeding industry including farmers and breeding organisations. This for instance means that one can directly contact Interbull with questions about international evaluations.
- Interbull should take the lead in providing international standards and global rankings. Interbull could than make a call for breeding values that are based on data that agrees to the international standards and compute international evaluations using unity correlations.
- Interbull should invest more in user group meetings, customer surveys, marketing international evaluations.

All those points can only be adressed by Interbull if they are supported in doing this by national evaluation centres, herdbooks and breeding organisations.

References

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Table 1. HG-index based on US breeding values (HGUS) and Dutch Breeding values (HGNL).

Bull	HGUS	ranking	HGNL	ranking
A	556	1	482	1
B	466	2	360	12
C	447	3	218	780
D	446	4	320	32
E	434	5	305	54
F	430	6	291	85
G	427	7	326	62
H	421	8	289	89
I	416	9	375	7
J	415	10	293	78
K	411	14	377	6
L	411	15	382	3
M	405	17	390	2
N	375	55	382	5
O	350	149	363	10
P	341	198	382	4
Q	340	203	368	8
R	275	1092	337	18

Table 2. Number of bulls that have a granddam with a given year of birth and a given PIDIF.

	PIDIF					
Birthyear granddam	-30--20	-20--10	-10-0	0-10	10-20	Total
1981	13	42	4	6		65
1982	19	63	6			88
1983	26	90	14			130
1984	11	17	11			39
1985	4	20	2			26
1986	7	72	62			141
1987		20	50	2		72
1988		22	126	80		228
1989		5	51	42	27	125
1990	4	19	11	31		65