Improved Prediction of National Genetic Evaluations by Including Information from INTERBULL Evaluations

Rex L. Powell
Animal Improvement Programs Laboratory, Agricultural Research Service,
U.S. Department of Agriculture, Beltsville, Maryland 20705-2350, USA

Introduction

Contributions to genetic progress from evaluation systems arise from improvements in methodology (quality) and use of more data (quantity). Often the two factors are related. To include data previously not accepted (national or international), methodology must be improved to edit, to adjust, and to weight the new information appropriately. Simply considering more data does not automatically lead to more accurate estimates of genetic merit.

If properly handled, more data should be preferred to less data. However, at this time, not everyone is convinced that the procedures used to produce INTERBULL evaluations are obvious improvements over the use of national data and conversion equations. Some countries do not accept INTERBULL results as official on their scale for any bulls, and INTERBULL evaluations often are not official if a national evaluation exists with a minimum reliability, even though it may contain only a fraction of the potential data.

Data differ according to time and space. Across time, daughter data for a bull usually increase within country. However, at any given time, additional data from other countries may be available, and including that information might improve estimates of genetic merit. A recent attempt to assess utility of foreign data in INTERBULL evaluations was hampered by too short a time span (Powell and Norman, 1998). Although results supported the value of including foreign data, examination of more extensive data for a longer interval was needed to confirm or refute the results. The objective of this study was to evaluate the degree to which the expansion of data at a given time can improve prediction of national evaluations at a later time.

Data and methods

Basic data were the national evaluations from nine countries that were input data for February 1995 INTERBULL evaluations for Holsteins. Those evaluations were recalculated by the INTERBULL Centre to provide international evaluations for milk, fat, and protein on each national scale. The methodology for August 1997 INTERBULL evaluations (Schaeffer, 1994; Banos and Sigurdsson, 1996) was used, which included an edit for minimum birth year of 1980, but genetic correlations and variances were those calculated from May 1995 test evaluations and used for August 1995 evaluations. Canadian evaluations for 1995 had been reported in units of breed class averages and transmitting abilities and were changed to kilograms of breeding value. This study considered evaluations for Canada, Germany, Italy, The Netherlands, and the United States. Evaluations were in pounds of transmitting ability for the United States and in kilograms of breeding value for other countries.

For Holstein bulls with I95 evaluations that included daughter information from that country and at least one other country, the data set for each of the five countries consisted of national (**N95**) evaluations used as data for February 1995 INTERBULL evaluations, the February 1995 INTERBULL (**I95**) evaluations on that country's scale, and recent 1997 national (**N97**) evaluations. The numbers of bulls and the N97 evaluation dates are in Table 1 along with the numbers of bulls that had twice as many daughters for I95 as for N95 evaluations among the 30% of bulls with the largest increases in daughter numbers between N95 and N97 evaluations. These subsets were examined because earlier national evaluations would predict later national evaluations best if national data increased only slightly, even if the earlier national evaluations were not as closely

Table 1. Evaluation month for N97 data and numbers of bulls that had both national and foreign daughter information in I95 evaluations and a subset of those bulls that had twice as many daughters for I95 as for N95 evaluations among the 30% of bulls with the largest increases in daughter numbers between N95 and N97 evaluations.

		Number of bulls	
Country	N97 evaluation month	All	Increased daughter data
Canada	November	349	86
Germany	August	207	51
Italy	December	159	46
The Netherlands	November	267	78
United States	November	605	81

related as the INTERBULL evaluations to true genetic merit. Also, comparisons of the merits of N95 and I95 evaluations as predictors of N97 evaluations would not be informative if the N95 and I95 evaluations were based on essentially the same data.

Correlations and standard deviations (**SD**) of differences of N97 with N95 and I95 evaluations were used to assess the usefulness of INTERBULL evaluations as predictors of later national evaluations despite the strong part-whole relationship between earlier and later national evaluations. Base changes had occurred for Canada and Italy, but correlations and SD of differences should be unaffected. Changes in national evaluation systems from the earlier to later evaluations would make the conclusions less pertinent to the present situation but still useful.

Results

Correlations between N95 and N97 (Table 2) evaluations generally were slightly higher by ≤.015 than between I95 and N97 evaluations for Canada, Germany, The Netherlands, and the United States. However, for Italy, correlations between N95 and N97 evaluations were lower by .015 to .031 than between I95 and N97 evaluations. Median increase in daughter numbers from N95 to N97 was 37% for Italy compared with 3 to 11% for other countries. The correlations did not indicate that using foreign data (I95) to predict later national evaluations (N97) was either an obvious gain or detriment.

The SD of differences (Table 2) between either N95 or I95 evaluations and N97 evaluations were not markedly different for Canada but were slightly smaller for I95 differences for the United States and clearly smaller for Germany, Italy, and The Netherlands. Based on SD of differences, the INTERBULL evaluations were more predictive of later national evaluations.

Correlations and SD for bulls with largest increases in daughter numbers nationally and internationally are in Table 3. As expected, correlations were lower than those in Table 2, especially between N95 and N97 evaluations. Correlations and SD of differences indicated better prediction of N97 evaluations from I95 evaluations than from N95 evaluations except for the United States, which had slightly lower correlations of I95 and N97 evaluations for milk and protein yields.

Including foreign data did not appear as useful for Canada and the United States as for other countries, especially as judged by SD. One possibility is that Canada and the United States have been exporting countries and foreign, second-country data

Table 2. Correlations between evaluations and SD of differences between evaluations.

	Correlation						SD[1]					
	N95 and N97			I95 and N97			N97 – N95			N97 – I95		
Country	Milk	Fat	Protein	Milk	Fat	Protein	Milk	Fat	Protein	Milk	Fat	Protein
Canada	.968	.956	.965	.965	.948	.963	213	8.3	6.2	203	8.4	6.1
Germany	.973	.961	.964	.971	.946	.964	122	5.3	4.0	71	4.2	2.0
Italy	.920	.945	.912	.947	.960	.943	191	5.3	6.1	83	3.0	2.4
The Netherlands	.956	.944	.958	.951	.939	.956	185	7.2	5.2	85	2.9	2.3
United States	.983	.979	.982	.971	.972	.972	150	5.6	4.5	144	4.9	4.0

[1]Pounds of transmitting ability for United States; kilograms of breeding value for other countries.

Table 3. Correlations between evaluations and SD of differences between evaluations for bulls had twice as many daughters for I95 as for N95 evaluations among the 30% of bulls with the largest increases in daughter numbers between N95 and N97 evaluations.

	Correlation						SD[1]					
	N95 and N97			I95 and N97			N97 – N95			N97 – I95		
Country	Milk	Fat	Protein	Milk	Fat	Protein	Milk	Fat	Protein	Milk	Fat	Protein
Canada	.898	.902	.897	.941	.921	.940	308	10.9	8.7	237	10.5	7.5
Germany	.925	.871	.897	.942	.903	.916	180	8.9	6.2	66	2.5	1.8
Italy	.874	.919	.876	.907	.938	.908	214	6.2	6.8	101	3.2	3.1
The Netherlands	.867	.893	.883	.877	.906	.902	229	8.2	6.6	84	2.8	2.3
United States	.936	.920	.943	.925	.922	.937	250	10.1	7.7	226	8.1	6.0

[1]Pounds of transmitting ability for United States; kilograms of breeding value for other countries.

are not as useful to them. Conversely, for the other three countries, including foreign data generally means using information from North American first-crop daughters. Most sires (≥99%), dams (≥86%), and maternal grandsires (≥99%) were North American; more than two-thirds were from the United States. Using foreign data, including ancestors, would benefit European countries more than Canada and especially the United States. More of the bulls considered in this study were from the home country for the United States (83%) and Canada (37%) than for Germany (15%), Italy (8%), and The Netherlands (17%).

Conclusions

Overall for bulls with I95 evaluations that included national evaluation data from an individual country and at least one other country, correlations with N97 evaluations generally were higher for N95 evaluations than for I95 evaluations. This result is attributed to the strong part-whole relationship for national evaluations over time. However, for Italy, correlations with N97 evaluations were higher for I95 evaluations than for N95 evaluations. That difference may be a reflection of improvements in the Italian evaluation system or may result from the larger increase in daughters from N95 to N97 evaluations compared with increases for the other countries. The combination of factors is indicated by lower correlations between national evaluations for Italy. Although SD of evaluation differences indicated better predictions from I95 evaluations than from N95 evaluations, improvements were small for Canada and the United States. Requiring that I95 and N97 evaluations contain minimum increases in data from N95 evaluations showed more clearly the benefit of including foreign data from INTERBULL evaluations when predicting national evaluations. Improvement from including foreign data is more useful for imported rather than exported bulls and for importing rather than exporting countries.

Literature Cited

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