Effect of economic indexes on international sire selection

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Breeders often have struggled to make reasonable decisions from an array of genetic information for each animal. Too frequently, independent culling levels have led to poor choices. Indexes are promoted as the solution and lead to proper choices if the index weights are correct for the situation. The index weights may be based on research, a committee decision, or history. In the United States, the weights applied to yield traits by the U.S. Department of Agriculture are based on the previous calendar year's national average milk price, including protein and fat differentials and some deductions. Other indexes for yield data (Table 1) may be more forward looking but carry some risk because the future market is unknown. Indexes other than from the United States either did not include milk or gave it a negative weight. This report documents the relationships between various national indexes for yield data and only examines the impact of using different indexes.

Data were February 1995 INTERBULL evaluations for 48,962 Holstein bulls. Bulls were required to have evaluations for all three yield traits and birth years from 1950 through 1990. Indexes compared were those from Canada, Denmark, France, Germany, Italy, The Netherlands, and the United States.

TABLE 1. Weights applied to yield traits in national economic indexes of seven countries.

Country	Milk	Fat	Protein	Protein percentage
Canada		3	8	
Denmark	−.004	.28	.724	
France			2.30	34.5
Germany		.15	.60	
Italy	−.778	4.5	50.8	
Netherlands	−.15	2	12	
United States	.05466	.58	1.47	

The indexes were applied to evaluations on a U.S. evaluation basis, and correlations were computed (Table 2). To remove the exaggeration in correlation due to genetic trend, the correlations were computed from residuals after fitting birth year. Correlations between these indexes were generally high (from .9 to nearly 1.0) except for correlations for the United States with Italy and The Netherlands. Correlations among indexes from Canada, Denmark, and Germany were above .99.

Correlations (not shown) of indexes with evaluations for protein yield on a U.S. evaluation basis ranged from .885 to .987. The lowest correlation was for Italy. Italy's high negative weight for milk yield may reduce emphasis on protein yield through the genetic correlation between milk and protein yields in addition to the intended negative emphasis on total volume.

The top 100 bulls for each index were identified by country with the most reported daughters (Table 3). For each country, differences in numbers of top bulls among the indexes were sizeable. Even if numbers of top bulls for a country were the same for different indexes, the sets of bulls could be quite different.

TABLE 2. Correlations between economic indexes applied to international evaluations expressed on the U.S. scale with effects of birth year removed.

Country[1]	Canada	Den-mark	France	Ger-many	Italy	Nether-lands	United States
Canada		.996	.960	.998	.900	.956	.963
Denmark	.996		.962	.991	.926	.975	.933
France	.960	.962		.971	.955	.977	.902
Germany	.998	.991	.971		.897	.956	.968
Italy	.900	.926	.955	.897		.986	.761
Netherlands	.956	.975	.977	.956	.986		.852
United States	.963	.933	.902	.968	.761	.852	

[1]Country of index.

TABLE 3. Numbers of bulls among the top 100 when applying various national yield indexes to INTERBULL evaluations on a U.S. evaluation basis.

	Country of index						
Country[1]	Canada	Den-mark	France	Ger-many	Italy	Nether-lands	United States
United States	62	62	57	64	47	53	71
Netherlands	23	22	22	19	31	27	17
France	12	13	16	14	17	16	10
Germany	2	2	2	2	3	3	0
Italy	1	1	2	1	0	0	2
Denmark	0	0	1	0	2	1	0
Other countries	0	0	0	0	0	0	0

[1]Country with most reported daughters for bull.

The impact of selection based on the various indexes was examined by determining the difference in the mean index for the top 100 bulls selected on one index versus other indexes and expressing that difference in units of standard deviation (SD) for the 14,277 bulls born in 1986 or later. For example, the difference between the mean Canadian indexes of the top 100 bulls for the Canadian index and of the top 100 bulls for the Danish index was divided by the SD of the Canadian index for all bulls. This procedure produced a measure in SD units of loss from selection on another index (Table 4). If the correlation between countries (Table 2) was high, the loss from selection on another index was small. However, if the correlation was about .9, loss was .2 to .3 SD. The four largest losses from selection on another index ranged from .4 to .7 SD and involved comparisons of the United States with Italy and The Netherlands.

Only yield traits were included in this study. Most national indexes include other traits, for example, type, health, and longevity. These results stress the importance of using an index with proper weights, which will differ from farm to farm as well as from country to country. Progress may depend more on the choice of an index for a country or an individual breeder than on the replacement of national with international evaluations.

TABLE 4. Mean loss in index standard deviation units for the top 100 among 14,277 bulls selected on a different index.

	Country of proper index						
Country of test index	Canada	Den-mark	France	Ger-many	Italy	Nether-lands	United States
Canada		.010	.066	.004	.273	.120	.112
Denmark	.011		.072	.025	.212	.081	.185
France	.116	.110		.082	.106	.065	.283
Germany	.005	.023	.051		.273	.125	.096
Italy	.207	.139	.059	.202		.018	.550
Netherlands	.121	.068	.041	.120	.022		.419
United States	.106	.188	.168	.095	.680	.433	