Report on COPA/INTERBULL joint project[1]

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The objective of this project is to investigate the feasibility to combine sire evaluations from INTERBULL member countries for a joint ranking of sires, with regards to dairy production traits, across countries of the European Community (EC). Initially only the Black and White breed was considered, but other breeds will be included in the near future.

Pedigree data base

The first step consists of data collection and creation of an international data base with respect to sire pedigree and national evaluation information. Since EC countries have made substantial imports from North America, information from the USA and Canada were included. Pedigree data were collected from various countries as follows:

Country	ISO code	# bulls
ITALY	(ITA)	5487
FRANCE	(FRA)	8990
NETHERLANDS	(NLD)	7147
GERMANY	(DEU)	56879
CANADA	(CAN)	25465
USA	(USA)	87633

Several other countries (first column) were represented in the pedigree files of the participating countries (first row), as demonstrated by the following numbers of bulls:

	CAN	USA	ITA	FRA	NLD	DEU
CAN		1010	857	268	197	368
USA	2497		1179	646	504	828
ITA						1
FRA			26			7
NLD			81	56		336
DEU			68	57	645	
GBR				63	1	
DNK			6	3		
SWE			9	2		
ISR				1	6	
CHE					1	
NZL	20				6	

[1] Distributed at the INTERBULL open meeting, June 7-8, 1992, Neustift, Austria.

From this table USA and CAN appear to be principally exporters, ITA importer, and the others both.

Animal identification included country of registration and identification within country. All files were examined for valid information, and multiple identification of bulls. A cross classification list including 9175 records of multi-registered bulls was used. The identification in the country of first registration was considered for all male animals. After all duplicates were removed, the final pedigree file had the following setup:

188,134	BULLS, BORN 1944 - 1990	
10,084	WITH MISSING BIRTH YEAR	(5%)
15,511	WITH MISSING SIRE	(8%)
12,896	WITH MISSING DAM	(7%)
34,244	WITH MISSING MGS	(18%)
133,338	WITH MISSING MGD	(71%)

This information was used to assign population of origin to each bull. Since most maternal grandams were missing, only information on sire, dam , and MGS was used, according to the following equation:

Bull origin=.5(sire origin) + .25(dam origin) + .25(MGS origin)

Sire evaluation data base

The second phase involved the creation of a data base including sire evaluations from various countries. Milk, fat, and protein yield were the traits of choice. Only countries that calculate Daughter Yield Deviations (DYD) were considered. Results from the following national evaluations were used:

Country	Evaluation run		Evaluation base	
ITA	January	1992	F-Cow	1985
FRA	April	1992	R-Bull	1991
NLD	April	1992	F-Bull	1988
DEU	March	1992	F-Cow	1985
USA	January	1992	F-Cow	1990

Bulls were required to have daughters in at least 10 herds. Two different data sets were built: a) including proofs of all bulls evaluated in all countries (ALP); b) including only proofs of bulls first sampled in each country (FSP). The latter excluded all proofs in the importing country of bulls that had been first progeny tested in the exporting country. Proofs of these bulls in the country of first sampling, however, were kept in the data. Therefore, in the absence of heterosis and if all proofs were unbiased, ALP and FSP should give the same results. Proofs of bulls simultaneously tested in more than one countries were included in both cases. The following numbers of bulls and records were kept:

	ALP		FSP	
	MILK/FAT	PROTEIN	MILK/FAT	PROTEIN
ITA	4187	4187	3311	3311
FRA	10001	9827	9228	9069
NLD	6098	6098	5604	5604
DEU	7420	7420	6471	6471
USA	21159	14416	21159	14416
TOTAL RECORDS	48865	41948	45773	38871
TOTAL BULLS	46445	39601	45494	38600

Exclusion of imports resulted in a reduction of about 8% in the NLD and FRA data sets, 13% in DEU and 21% in ITA.

Subsequently, Daughter Yield Deviations were standardized within country. This was done to remove the effect of different unit and base for age adjustment definition in each country. The standardization factor was calculated as the square root of the product of the standard deviations of sire estimated transmitting ability and DYD. This would give an approximation of the true sire standard deviation. Standard deviations were calculated within birth year and then pooled across years. In each case, bulls were initially sampled in the corresponding country and were born after 1970. The following standardization factors were calculated by country and trait.

Country	Milk	Fat	Protein	unit
ITA	271	9.63	7.85	I-kg
FRA	323	11.49	8.48	F-kg
NLD	234	8.90	6.43	N-kg
USA	664	22.83	18.38	U-lb
DEU	234	9.34	6.51	D-kg

Units are pounds in USA and kg in all other countries. Pairwise ratios correspond to conversions between estimated transmitting abilities in different countries.

Model of international evaluation

A pilot evaluation run across these countries was performed. Standardized DYD were analyzed across countries by a linear model, including the effects of: 1) evaluation country; 2) genetic group; 3) sire within group. Genetic groups were defined by birth year and population of origin. Eight populations of origin were considered: ITA, FRA, NLD, USA, DEU, CAN, GBR, and OTHERS. This was a result of heavy presence of CAN and GBR bulls in the pedigree, although these two countries did not participate with proofs. The same model was used for ALP and FSP, for all traits. All male relationships among bulls, within and across countries, were utilized. After obtaining solutions to the above equations, the international proof was formed as the sum of group and sire solution. Comparisons between the international evaluations and pairwise conversions were made.

Some results of international evaluation in comparison to conversions

Differences between country solutions represent reference base differences between pairs of countries. These are equivalent to the a-values calculated for conversions. Following are some comparative examples between reference base differences estimated by the joint (international) evaluation with all proofs (ALP) and only first sampling proofs (FSP), as well as official conversion intercepts (CON). Conversion factors were made available by the official agencies for national evaluation in each country. First country is the importing one. Values are back-transformed to unit and base equivalent of the importing country. Values would result to conversion of transmitting ability in one country to transmitting ability in the other.

Countries	Milk			Fat			Protein		
	ALP	FSP	CON	ALP	FSP	CON	ALP	FSP	CON
ITA - USA	376	370	369	14.1	12.5	14.0	12.6	8.6	12.1
FRA - USA	210	144		.2	-.9		4.1	1.8	
NLD - USA	331	300	313	.5	1.2	.5	6.0	5.1	6.0
DEU - USA	392	320		3.1	1.9		6.5	4.6	
ITA - NLD	-8	22	-14	13.6	11.2	12.0	5.2	2.4	3.5
NLD - ITA	7	-19	54	-12.6	-10.3	-7.5	-4.3	-1.9	-1.5
NLD - FRA	179	196	162	.3	2.0	.5	2.9	3.7	2.5
ITA - DEU	-78	0	54	10.9	10.5	12.7	4.8	3.1	5.9
DEU - ITA	67	0	25	-10.6	-10.2	-4.6	-4.0	-2.5	-.4
NLD - DEU	-61	-19	24	-2.5	-.7	-2.5	-.4	.6	0.
DEU - NLD	61	19	-48	2.6	.7	.7	4	-.6	-.6

In general, there is good agreement between all methods. Differences between the EC countries and USA tend to decrease when only first sampling proofs are considered. This could be an indication of biased proofs of selected bulls that were first tested in USA and then imported by the EC countries.

Comparisons were also made between alternative rankings (international proof versus national and converted proof listings). Generally, in any two-country scenario, the relative ranking of bulls was similar under the two methods (within year rank correlations were close to unity).

In some cases, mean differences between international and converted proofs were affected by the choice of data (ALP versus FSP). It should be kept in mind that proofs in the importing country of many of the bulls used to derive conversions coefficients were excluded from the FSP analysis.

One example where choice of data influenced results, also in relation with conversions, is illustrated in the accompanied figures. Estimated breeding values of bulls for fat and protein, respectively, expressed in ITA base and unit equivalents are involved. National and international proofs of ITA bulls are compared to converted and international proofs of USA bulls. The latter were bulls without an official national proof in ITA. When all proofs were considered in the international evaluation, international proofs were very close to converted proofs. When only proofs in country of first sampling were considered, and all proofs on selected imports were excluded, international proofs decreased by an average of 3,5 kg fat and 7 kg protein, compared to ALP and conversions. This is likely due to biases in the excluded proofs of selected imports, which had been used to derive direct conversions between USA and ITA.

Conclusion

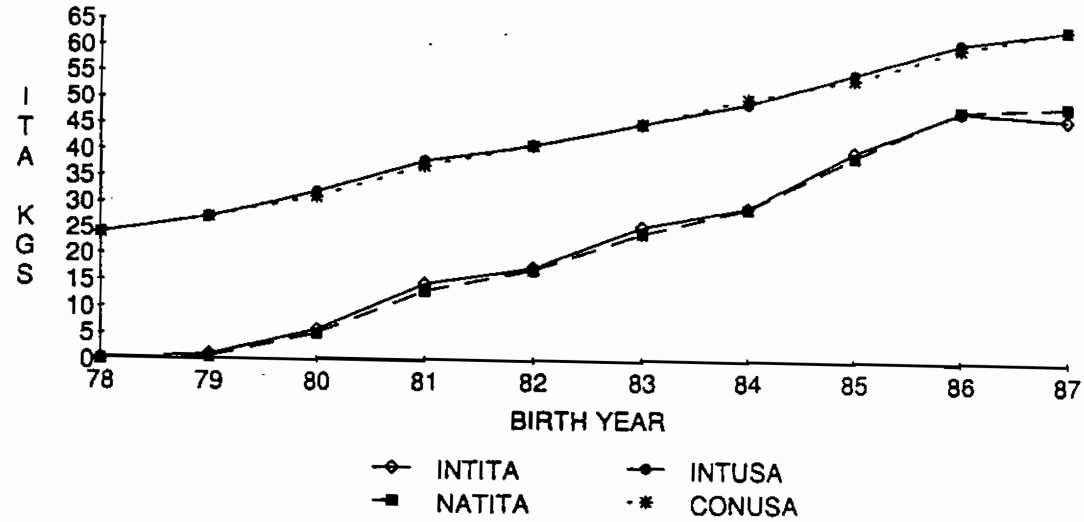
Creation of comprehensive international data bases with regards to sire pedigree and evaluation information for production traits is under way. A pilot genetic evaluation run across several EC countries and the USA, using this information, was performed to investigate the feasibility of simultaneous sire comparison across the EC. When proofs in the importing country of bulls first evaluated in the exporting country were excluded from the data, some results were affected. Possibly due to higher semen prices associated with these bulls in the importing country, their proof is based on biased records. Sources of bias could be: a) preferential mating to elite cows, b) preferential treatment of daughters, and c) selective usage of sires in high variance herds. Although a) and c) may be, theoretically, accounted for in the national evaluation, preferential treatment of daughters remains a serious problem. The fact that conversions between countries may be calculated based on such biased proofs should raise several concerns.

When international rankings are based on linear model combination of DYD and utilize relationships among sires, such potentially biased information can be excluded. On the assumption that the DYD are unbiased in the country of first sampling, and that there is no genotype by environment interaction among EC countries, sire rankings by the international linear model can provide useful selection tools across Europe.

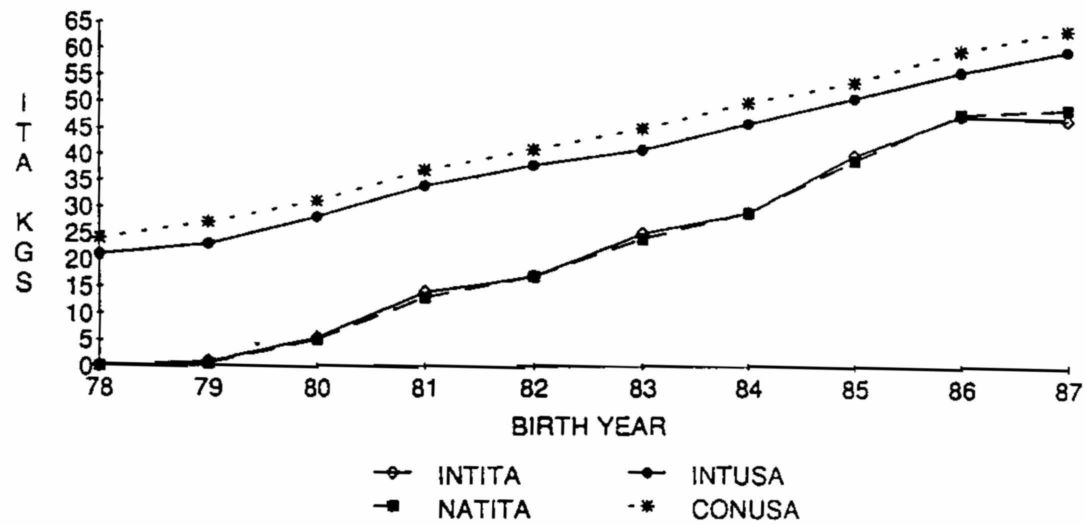
Future plans

Continuation of the project and expansion to include more countries, breeds, and traits is considered.

FAT
ALP



FAT
FSP

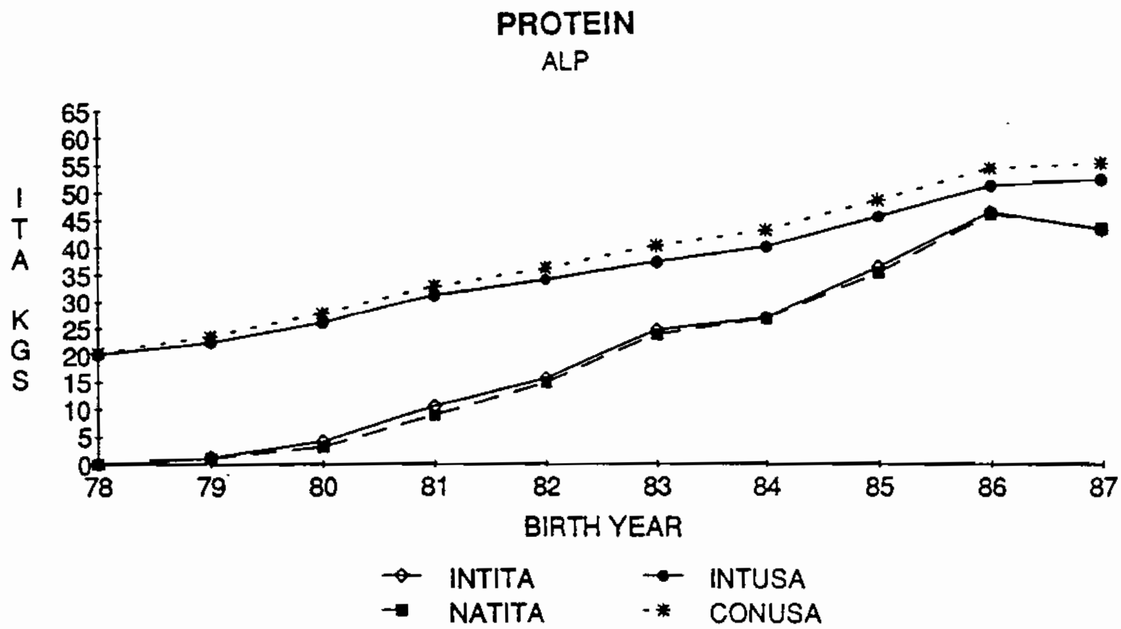


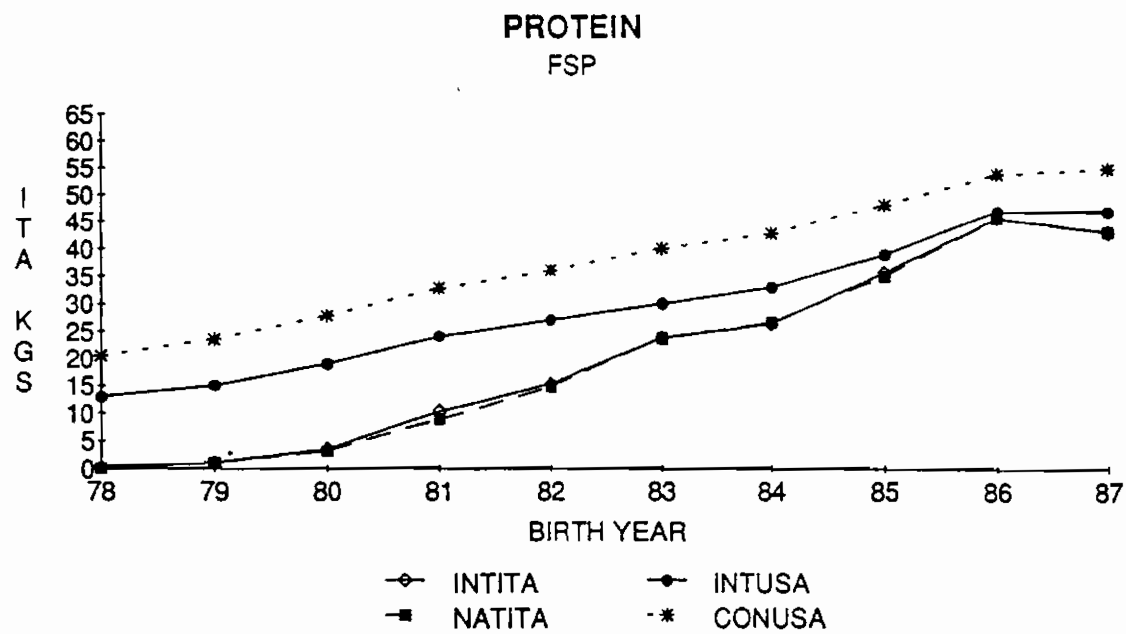
INTITA: ITA bulls, international proofs

NATITA: ITA bulls, national (ITA) proofs

INTUSA: USA bulls, international proofs

CONUSA: USA bulls, national (USA) proofs converted to ITA equivalent





INTITA: ITA bulls, international proofs

NATITA: ITA bulls, national (ITA) proofs

INTUSA: USA bulls, international proofs

CONUSA: USA bulls, national (USA) proofs converted to ITA equivalent