

Data description

Each participating country contributed three files: 1) a pedigree file; 2) a cross-classification list of bulls registered in more than one country; 3) a production (evaluation) file. The format of record layout for these files is shown in Appendix I.

Pedigree data base

The first step consisted of data collection and creation of an international data base with respect to bull pedigree and national evaluation information. Four EC countries provided data: Italy (ITA), France (FRA), the Netherlands (NLD), and Germany (DEU). Since EC countries have made substantial imports from North America, information from the United States of America (USA) and Canada (CAN) were included. Pedigree data were collected from various countries as shown in Table 1.

TABLE 1: Number of bulls with pedigree information provided by each country.		
Country		Number of bulls
ITALY	(ITA)	5487
FRANCE	(FRA)	12845
THE NETHERLANDS	(NLD)	7147
GERMANY	(DEU)	56879
UNITED STATES OF AMERICA	(USA)	87633
CANADA	(CAN)	26465

Bulls with registration numbers from several other countries were found in the pedigree file of each of the countries that had provided data. This cross-classification pattern is described in Table 2 (GBR: Great Britain; DNK: Denmark; SWE: Sweden; ISR: Israel; NZL: New Zealand; CHE: Switzerland).

TABLE 2: Number of bulls from other countries found in pedigree files of participating countries.						
Other countries	Countries with pedigree files					
	CAN	USA	ITA	FRA	NLD	DEU
CAN		1010	857	412	197	368
USA	2497		1179	951	504	828
ITA				16		1
FRA			26			7
NLD			81	987		336
DEU			68	403	645	
GBR				465	1	
DNK			6	14		
SWE			9	16		
ISR				8	6	
NZL	20				6	
CHE					1	

From Table 2 USA and CAN appear to be principally exporters, ITA and FRA importers, and the others both.

International 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 (MGS: maternal grand-sire; MGD: maternal grand-dam):

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 grand-dams were missing, only information on sire, dam, and MGS was used, according to Model 1.

$$\text{Bull origin} = .5(\text{sire origin}) + .25(\text{dam origin}) + .25(\text{MGS origin}) \quad [1]$$

For missing information in Model 1, weights would change accordingly to sum up to 1: in the presence of only one ancestor weight would be 1; in the presence of any two ancestors weights would be .5.

Bull evaluation data base

The second phase involved the creation of a data base including national evaluations (proofs) of bulls from the participating countries. Milk, fat yield, and protein yield were the traits of choice. Only countries that calculated Daughter Yield Deviations (DYD) from the national proofs were considered; DYD provided a de-regressed estimate of the average daughter performance of each bull, corrected for various fixed effects and the merit of his mates. Results from the following national evaluations were used:

Country	Evaluation run		Evaluation base
ITA	January	1992	Fixed: Cows born in 1985
FRA	April	1992	Rolling: Bulls born in 1981-1984
NLD	April	1992	Fixed: Bulls born in 1982
DEU	March	1992	Fixed: Cows born in 1985
USA	January	1992	Fixed: Cows born in 1985

Bulls were required to have daughters in at least 10 herds. Two different data sets were built: a) including national proofs of bulls in all countries (ALP); b) including national proofs of bulls only in the country of first sampling (FSP). The latter excluded all national proofs that were based on imported semen. If bulls were simultaneously tested in more than one country, all their first proofs were considered in FSP. In absence of heterosis and if all evaluations were unbiased, ALP and FSP should give the same results. Table 3 shows the final numbers of bulls and records kept in each subset. From this Table it appears that exclusion of imports resulted in a reduction of about 8% in the NLD and FRA data sets, 13% in DEU data set and 21% in ITA data set.

TABLE 3: Number of bulls and national proofs considered in international evaluation with all national proofs (ALP) and national proofs only in country of first sampling (FSP).

Country	ALP		FSP	
	Milk/Fat yield	Protein yield	Milk/Fat yield	Protein yield
ITA	4187	4187	3311	3311
FRA	10001	9827	9226	9067
NLD	6098	6098	5604	5604
DEU	7420	7420	6473	6473
USA	21159	14416	21159	14416
NATIONAL PROOFS	48865	41948	45773	38871
BULLS	46445	39601	45494	38600