Results and Discussion

Throughout the entire report all results are associated with proofs expressing bull estimated transmitting ability.

Correlations between national and international evaluations

Correlations between EC proofs based on all national proofs (ALP) and national proofs only in the country of first sampling (FSP) were .99, for all traits, considering bulls from any country. Correlations between EC and national proofs were also .99 for bulls from any country, except Germany, where correlations ranged from .93 to .97. This was expected because German national proofs are essentially indices of multiple lactation-traits, whereas EC proofs are associated with single traits.

High correlations obtained indicate similar rankings and consistency between the international and various national evaluation systems.

Country solutions

Country solutions for milk, fat yield, and protein yield are shown in Table 6; they are equivalent to the reference base in each country. The EC evaluation of a bull can be expressed at the base equivalent of any country by being added to the appropriate country solution. Pairwise differences between country solutions, multiplied by the correct standardization factor (from Table 4), correspond to intercepts (a-values) obtained from conversions. Differences in country solutions are further discussed at a later stage.

TABLE 6: Country solutions obtained from an international evaluation considering all national proofs (ALP) and only national proofs in the country of first sampling (FSP); values are unitless and comparable across country.

Country	Milk		Fat yield		Protein yield	
	ALP	FSP	ALP	FSP	ALP	FSP
ITA	-1.2800	-2.0258	-.9054	-1.5395	.8351	.2001
FRA	-2.0191	-2.9480	-2.3524	-2.9231	-.2836	-.6836
NLD	-1.2526	-2.1081	-2.3164	-2.6999	.1699	-.1062
DEU	-.9911	-2.0251	-2.0415	-2.6272	.2255	-.1980
USA	-2.6682	-3.3942	-2.3709	-2.8381	-.7644	-.8980

Genetic means

Genetic means (average EC proof) of bulls and standard deviations of the EC proofs by country of first sampling, for milk, fat yield, and protein yield are in Table 7. Average EC proofs are estimates of the transmitting ability of bulls born between 1978 and 1987. Both types of EC proofs, i.e. based on all national proofs and national proofs only in the country of first sampling are considered. Figures are unitless, therefore comparable across countries. These figures can be back-transformed to any country base and unit equivalent by first adding the country solution (from Table 6) and then multiplying by the standardization factor (from Table 4). For example, ITA-ALP for milk in Table 7 is shown 2.20; expressed in ITA units and base equivalent it would be (2.2044 - 1.2800)*271.01=250.51 kg.

TABLE 7: Means (M) and standard deviations (SD) of European Community proofs of bulls born 1978-1987, by country of first sampling (C1S), considering all national proofs (ALP) and only C1S national proofs (FSP); values are unitless and comparable across country.

C1S	No. of bulls	Milk				Fat yield				Protein Yield			
		ALP		FSP		ALP		FSP		ALP		FSP	
		M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
ITA	1145	2.20	1.36	2.96	1.36	1.96	1.36	2.58	1.36	.36	1.48	.97	1.48
FRA	5012	2.06	1.00	2.97	.99	2.37	1.05	2.93	1.05	.34	1.01	.73	1.01
NLD	3427	1.39	1.22	2.24	1.23	2.55	1.34	2.95	1.35	.09	1.31	.37	1.31
DEU	3902	1.41	1.00	2.43	.99	2.08	1.00	2.65	1.00	-.18	.96	.24	.95
USA	9928	3.42	1.08	4.20	1.07	3.14	1.05	3.61	1.04	1.43	1.05	1.59	1.0

European Community proofs based on national proofs from the country of first sampling only, are expected to be unbiased. National proofs of selected import bulls are possibly biased due to preferential treatment of daughters and/or selective usage in high variance herds, thus affecting the EC proof when included in the analysis. The potential

effect of such bias is shown in Table 7. Although excluding national proofs that were based on imported semen did not change the relative ranking of countries by mean EC proof, pairwise differences between countries were affected. In almost all cases including information based on imported semen resulted in inflated proofs of bulls from the exporting country (mainly USA) compared to excluding this information (e.g. USA-DEU mean difference increased by 10-19%, for different traits, when DEU proofs of imported USA semen were included in the analysis).

Standard deviations of EC proofs of ITA and NLD bulls were larger than of the others. This is due to higher genetic progress in these two countries, as will be discussed later.

The effect of excluding imported semen evaluations on the EC proof of USA bulls was also tested by comparing the difference ALP - FSP considering bulls first tested in USA and then imported into a European country with bulls first tested in this European country. Results of this comparison are in Table 8. For example, the average difference ALP-FSP of USA bulls imported into France is 64.53 kg, for milk.

From Table 8 it appears that bulls from the USA imported into a European country got a significantly higher EC proof based on all national proofs than based only on their USA national proof. This is another indication that national proofs based on imported semen may be biased, thus resulting in over-prediction of the bulls' genetic merit on the international scene. Average over-prediction varied across country reflecting differences in use of imported semen. Wider distribution of such semen in a population would reduce the effect of preferential treatment and consequently biases on evaluations, thereby decreasing ALP-FSP (e.g. NLD). Bulls first tested in the four European countries (including USA bulls simultaneously tested in Europe) got similar, on the average, EC proofs under ALP and FSP.

TABLE 8: Average difference between European Community proofs considering all national proofs and national proofs only in the country of first sampling (ALP-FSP), for USA bulls imported into European countries (IMP) and bulls first tested in these European countries (FST); values are expressed in kg equivalent to each country and are not comparable across country (standard errors in parentheses).

Country	# of bulls		Milk	Fat yield	Protein yield
ITA	IMP	574	8.01 (.75)	1.68 (.04)	3.87 (.03)
	FST	3311	-.05 (.11)	.11 (.02)	.20 (.02)
FRA	IMP	456	64.53 (.91)	1.26 (.04)	2.28 (.04)
	FST	9226	3.33 (.07)	.07 (.02)	.09 (.02)
NLD	IMP	339	22.02 (.97)	-.67 (.04)	.78 (.04)
	FST	5604	.40 (.08)	-.07 (.02)	-.02 (.02)
DEU	IMP	349	61.91 (.90)	1.02 (.04)	1.52 (.03)
	FST	6473	3.40 (.06)	.12 (.02)	.05 (.02)

Yearly change in average bull evaluation

The change in average EC proof by birth year, for bulls born between 1978 and 1987, is illustrated in figures 1, 2, and 3, for milk, fat yield, and protein yield, respectively.

European Community proofs considering both, ALP and FSP are considered. Related values are standardized EC proofs, i.e. are unitless and do not depend on base and unit definition in different countries. Evidently, countries like ITA and NLD have upgraded considerably in production traits, catching up to the superior exporter (USA).

Average bull evaluation changes were estimated for all countries and traits as regressions of their bulls' estimated transmitting ability on time and are shown in Table 9. These values relate to figures 1, 2, and 3, and are comparable across countries. Only bulls first sampled in each country, born between 1978 and 1986 were considered. Bulls born in 1987 were excluded from calculation of average bull evaluation changes, because their evaluations were largely based on very short daughter lactations.

TABLE 9: Change of bull estimated transmitting ability per birth year (1978-1986) for yield traits, by country of first sampling (C1S) and trait, under an international evaluation considering all national proofs (ALP) and only C1S national proofs (FSP); values are unitless.

C1S	Milk		Fat yield		Protein yield	
	ALP	FSP	ALP	FSP	ALP	FSP
ITA	.34	.34	.33	.33	.39	.39
FRA	.15	.14	.19	.19	.17	.16
NLD	.25	.25	.33	.33	.32	.32
DEU	.12	.12	.16	.16	.13	.13
USA	.26	.25	.24	.23	.24	.24

Yearly average bull evaluation changes expressed in units specific to each European country are shown in Table 10. These values are associated with individual European countries and are not comparable across countries. International average proof changes under both, ALP and FSP, are considered, in addition to national average proof changes in each country.

TABLE 10: Change of bull estimated transmitting ability per birth year (1978-1986) for yield traits, by country of first sampling (C1S) and trait, under an international evaluation considering all national proofs (ALP) and only C1S national proofs (FSP), and national evaluation (NAT); values are expressed in kg equivalent to each country and are not comparable across country (standard errors in parenthesis).

C1S	Milk			Fat yield			Protein yield		
	ALP	FSP	NAT	ALP	FSP	NAT	ALP	FSP	NAT
ITA	93.2 (5.3)	93.1 (5.4)	94.9 (5.5)	3.21 (.14)	3.21 (.15)	3.21 (.14)	3.04 (.18)	3.04 (.18)	3.06 (.18)
FRA	46.4 (5.6)	45.9 (5.5)	48.2 (5.4)	2.21 (.19)	2.21 (.18)	2.31 (.18)	1.37 (.14)	1.36 (.14)	1.45 (.14)
NLD	57.9 (2.7)	57.8 (2.7)	57.2 (2.8)	2.96 (.17)	2.95 (.17)	2.89 (.17)	2.04 (.07)	2.04 (.07)	1.98 (.07)
DEU	26.9 (2.9)	27.1 (2.8)	24.2 (2.4)	1.48 (.11)	1.49 (.10)	1.39 (.10)	.81 (.09)	.81 (.08)	.85 (.10)

Yearly average bull evaluation changes calculated for indirect evaluations of concentration traits are shown in Table 11. Values in this Table are multiplied by a factor of 100.

TABLE 11: Change of bull estimated transmitting ability per birth year (1978-1986) for concentration traits, by country of first sampling (C1S) and trait, under an international evaluation considering all national proofs (ALP) and only C1S national proofs (FSP), and national evaluation (NAT); values are expressed in % *100 (standard errors in parenthesis).

C1S	Fat %			Protein %		
	ALP	FSP	NAT	ALP	FSP	NAT
ITA	- .12 (.19)	- .11 (.19)	-.15 (.18)	.21 (.10)	.23 (.11)	.19 (.08)
FRA	.64 (.15)	.65 (.15)	.73 (.15)	.00 (.08)	.00 (.08)	.06 (.08)
NLD	.78 (.22)	.77 (.23)	.83 (.24)	.16 (.06)	.16 (.06)	.18 (.07)
DEU	.55 (.11)	.55 (.11)	.59 (.11)	-.10 (.04)	-.12 (.04)	.12 (.06)

From results shown in Tables 9, 10, and 11, it can be concluded that EC average proof changes were practically the same for ALP and FSP; evaluation changes estimated from EC proofs were also similar to changes estimated from national proofs in each country. Same average changes in both, the national and international evaluations, were also observed for USA. This is an indication of consistency between the international and the various national evaluation systems. Highest rates of genetic gain for yield traits were observed in ITA and NLD ; this has resulted in larger standard deviations associated with EC proofs of ITA and NLD bulls, as was shown in Table 7. Average evaluation changes for concentration traits

were very small, given that figures in Table 11 are multiplied by 100, i.e. represent changes to be achieved in 100 years.

Average bull evaluation yearly changes were also calculated based on pedigree indices (PI=1/2 sire + 1/4 MGS) considering European bulls with sires and maternal grand-sires first sampled in USA. This was done to investigate selection policies in the four participating EC countries. Average pedigree indices of such bulls born between 1978 and 1987 are shown in Table 12. Yearly changes are shown in Table 13. Corresponding figures for bulls first sampled in the USA were added in Tables 12 and 13 for comparative purposes. Both EC proofs (ALP and FSP) of the ancestors were considered; however, since both gave very similar results, only FSP is shown here. Realized changes using FSP of the same bulls are included in Table 13, to provide a comparison between realized (EC proof) and expected (pedigree index) average bull evaluation changes. In calculation of such changes, bulls born in 1987 were excluded, because their evaluations were based on very short lactation records. All values in Table 12 and 13 are in USA pounds, therefore are comparable across countries. Corresponding figures for milk component concentration traits (fat % and protein %) were not significantly different than zero.

Tables 12 and 13 show the relative emphasis placed by various countries in selecting bull-sires from the USA. Values in Table 13 also reflect differential usage of USA genetics in different time periods. Over the last 10 years, ITA has been consistently emphasizing on milk and protein yield; FRA has been selecting high producers, on the average, but not as intensively; NLD has been mainly focusing on high fat and protein producers in a way favouring concentration of these components; compared to the other traits, DEU emphasized on fat yield.

TABLE 12: Mean international pedigree index of European and USA bulls with USA sire and maternal grand-sire, born 1978-1987, by country of first sampling (C1S) and trait; values are expressed in USA pounds and are comparable across country (standard errors in parenthesis).

C1S	No. of bulls	Milk	Fat yield	Protein yield
ITA	477	241.8 (25.9)	6.74 (.81)	7.77 (.60)
FRA	2473	124.8 (9.0)	12.92 (.29)	6.67 (.25)
NLD	1466	-22.0 (13.8)	21.39 (.37)	10.20 (.38)
DEU	1851	-185.1 (11.0)	8.21 (.33)	1.00 (.26)
USA	9308	479.1 (1.0)	15.53 (.17)	13.34 (.14)

TABLE 13: Change per birth year (1978-1986) of international pedigree index (PI) and European Community proof considering only country of first sampling (C1S) national proofs (FSP) of European and USA bulls with USA sire and maternal grand-sire, by C1S and trait; values are expressed in USA pounds and are comparable across country (standard errors in parenthesis).

C1S	Milk		Fat yield		Protein yield	
	PI	FSP	PI	FSP	PI	FSP
ITA	155.4 (9.9)	166.3 (14.4)	4.30 (.48)	4.85 (.74)	3.72 (.35)	4.95 (.60)
FRA	112.0 (11.5)	76.8 (13.3)	4.42 (.24)	3.15 (.35)	2.82 (.33)	1.80 (.36)
NLD	98.5 (19.1)	74.2 (19.3)	3.89 (.39)	4.39 (.35)	3.61 (.41)	3.65 (.44)
DEU	83.2 (7.8)	69.5 (12.5)	3.40 (.19)	3.08 (.39)	2.13 (.23)	1.99 (.34)
USA	142.1 (3.5)	168.0 (5.3)	4.57 (.32)	5.42 (.17)	3.64 (.26)	4.35 (.17)

Differences between expected and realized average bull evaluation changes per year (Table 13) for bulls with USA ancestry varied among countries. Realized changes were generally smaller than expected in FRA and, to a lesser extend, in DEU, and larger in ITA and USA. Since PI was based on sire and MGS only, it is likely that these discrepancies reflect differences in selection policies with regards to the MGD across country. In France, which is associated with the largest discrepancies in Table 13, such differences had been also observed when PI was based on sire and dam (Bonaiti, 1990). In such case the explanation regarding MGD selection is insufficient; another explanation could be differences in the various national evaluation systems. Pertinent research (Banos et al, 1992) has shown that different national evaluation procedures applied on the same data sets may result in somewhat different estimates of average bull evaluation change per year. When inconsistencies in estimation of average bull evaluation change within any national evaluation system exist leading to discrepancies among various national evaluation systems, any attempt to use national proofs to compare bulls at the international level will be problematic. Consequently, prior to establishing an EC evaluation system, similarities in such estimation among national evaluation systems have to be checked and found reasonable. Individual countries should be able to validate their genetic progress estimation procedure at national level using the method by Bonaiti (1993). At the same time, additional research should focus on harmonizing genetic progress estimations in various national evaluation systems, in addition to other potential sources of systematic variation.

Comparison between conversions and international evaluation with a linear model

Pairwise differences between country solutions obtained from the linear model analysis (Table 6) multiplied by the appropriate standardization factor (from Table 4) represent reference base differences between pairs of countries. These are equivalent to the a-values in conversions. Table 14 shows some comparative examples between reference base differences for yield traits estimated by the linear model considering all national proofs (ALP) and national proofs only in the country of first sampling (FSP), as well as official conversion intercepts calculated by each country. The country in first column has calculated the official conversion. In each case, values are associated with unit and base equivalent to the importing country (first column). Values would result to conversion of transmitting ability in one country to transmitting ability in the other.

TABLE 14: Country differences in international evaluations considering all national proofs (ALP) and national proofs only in country of first sampling (FSP) and official conversion intercepts (CON); values expressed in kg equivalent to the country in first column.

Countries		Milk			Fat yield			Protein yield		
To	From	ALP	FSP	CON	ALP	FSP	CON	ALP	FSP	CON
ITA	USA	376	370	369	14.1	12.5	14.0	12.6	8.6	12.3
FRA	USA	210	144	114	.2	-.9	-5.0	4.1	1.8	.5
NLD	USA	331	300	313	.5	1.2	.5	6.0	5.1	6.0
DEU[1]	USA	392	320	123	3.1	1.9	-4.6	6.4	4.6	1.7
ITA	NLD[2]	-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
FRA	NLD	-248	-271	-187	-.4	-2.6	-4.9	-3.9	-4.9	-4.4
FRA[3]	DEU[3]	-332	-298	-174	-3.6	-3.4	-2.5	-4.3	-4.1	-3.5
DEU[3]	FRA[3]	240	215	200	2.9	2.8	4.1	3.3	3.1	2.8
ITA	DEU[1]	-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	-.3
DEU[1]	NLD[2]	61	19	-48	2.6	.7	.7	4.0	-.6	-.6
NLD	DEU	-61	-19	24	-2.5	-.7	-2.5	-.4	.6	.0

[1] Conversion based on December 1991 evaluation
[2] Conversion based on October 1991 evaluation
[3] Conversion based on September 1991 evaluation

Pairwise ratios of the standardization factors shown in Table 4 correspond to slope estimates in conversions. Table 15 shows some examples comparing these ratios to official slope estimates.

TABLE 15: Ratios of standardization factors used in linear model evaluation (LME) and official conversion slopes (CON); values are expressed in kg equivalent to the country in first column.

Countries		Milk		Fat yield		Protein yield	
To	From	LME	CON	LME	CON	LME	CON
ITA	USA	.41	.38	.42	.39	.43	.44
FRA	USA	.49	.43	.50	.50	.46	.43
NLD	USA	.35	.29	.39	.36	.35	.29
DEU[1]	USA	.35	.32	.41	.36	.35	.31
ITA	NLD[2]	1.16	1.22	1.08	1.00	1.22	1.38
NLD	ITA	.86	.69	.92	.75	.82	.62
NLD	FRA	.73	.94	.78	.88	.76	.84
FRA	NLD	1.38	1.09	1.29	1.21	1.32	1.15
FRA[3]	DEU[3]	1.38	1.25	1.23	1.26	1.30	1.27
DEU[3]	FRA[3]	.73	.65	.81	.72	.77	.65
ITA	DEU[1]	1.16	1.28	1.03	1.04	1.21	1.38
DEU	ITA	.86	.56	.97	.64	.83	.49
DEU[1]	NLD[2]	1.00	.77	1.05	.78	1.01	.76
NLD	DEU	1.00	1.12	.95	1.07	.99	1.04

[1] Conversion based on December 1991 evaluation
[2] Conversion based on October 1991 evaluation
[3] Conversion based on September 1991 evaluation

In many cases, conversion coefficient estimates were based on a limited number of selected bulls; also, several different methods of coefficient calculation were used. Difficulties in comparisons of the above intercepts and slopes then, become an inherent problem. Country solution differences between the EC countries and USA decreased when national proofs only in the country of first sampling were considered. This could be another indication of upwards biased proofs of selected bulls that were first tested in USA and then imported by the EC countries.

Genetic means (average EC proof) of bulls by country of first sampling (ITA, FRA, NLD, DEU, USA) expressed in base and unit equivalent to the four European countries of evaluation (ITA, FRA, NLD, DEU) for milk, fat yield, and protein yield, are in Tables 16, 17, and 18, respectively. Average EC proofs are estimates of the transmitting ability of bulls born between 1978 and 1987. Both types of international evaluations, based on all national proofs and national proofs only in the country of first sampling are considered. Tables 16, 17, and 18 also include the average of officially converted proofs of the same bulls from the country of first sampling to the European country of evaluation. This provides a within European country comparison of bulls first sampled in any of the five participating countries,

considering conversions and linear model EC proofs. For example, in Table 16 the average milk proof of bulls first tested in NLD converted to ITA is 24 ITA-kg, whereas the average EC proof of these bulls is 29 ITA-kg considering all national proofs and 58 ITA-kg considering national proofs only in the country of first sampling. In the case of the same country, the average national proof is considered instead of converted proof.

TABLE 16: Average European Community proof for **milk** of bulls born 1978-1987, by country of first sampling (C1S), in base equivalent of the 4 European countries of evaluation, considering all national proofs (ALP) and only C1S national proofs (FSP), converted proofs (CON) from C1S to European countries, and standard errors (SE) range; values are expressed in kg equivalent to each European country and are not comparable across European country of evaluation.

C1S	European country of evaluation											
	ITA (ITA-kg)			FRA (FRA-kg)			NLD (NLD-kg)			DEU (DEU-kg)		
	ALP	FSP	CON	ALP	FSP	CON	ALP	FSP	CON	ALP	FSP	CON
ITA	251	253	253	60	4		223	199	229	284	218	166
FRA	210	256		12	8	-10	188	202	152	249	221	193
NLD	29	58	24	-204	-228	-153	31	31	31	92	50	-25
DEU	36	110	142	-196	-166	-88	38	76	101	99	96	69
USA	581	587	579	455	403	349	508	488	477	570	508	297
SE	8.3 - 8.8			9.6 - 11.2			7.2 - 7.9			7.5 - 8.3		

TABLE 17: Average European Community proof for **fat yield** of bulls born 1978-1987, by country of first sampling (C1S), in base equivalent of the 4 European countries of evaluation, considering all national proofs (ALP) and only C1S national proofs (FSP), converted proofs (CON) from C1S to European countries, and standard errors (SE) range; values are expressed in kg equivalent to each European country and are not comparable across European country of evaluation.

C1S	European country of evaluation											
	ITA (ITA-kg)			FRA (FRA-kg)			NLD (NLD-kg)			DEU (DEU-kg)		
	ALP	FSP	CON	ALP	FSP	CON	ALP	FSP	CON	ALP	FSP	CON
ITA	10.1	10.1	9.7	-4.5	-3.9		-3.2	-1.1	-.3	-.8	-.4	1.7
FRA	14.1	13.3		.2	.1	-.5	.4	2.0	.1	3.0	2.8	3.7
NLD	15.9	13.5	14.2	2.3	.3	-2.4	2.1	2.2	2.2	4.8	3.0	2.3
DEU	11.3	10.7	14.2	-3.2	-3.1	-.7	-2.2	-.4	-1.0	.3	.2	1.4
USA	21.5	19.9	21.2	9.0	7.9	4.3	7.3	8.1	7.1	10.2	9.2	2.0
SE	.3 - .6			.3 - .5			.1 - .4			.1 - .5		

TABLE 18: Average European Community proof for **protein yield** of bulls born 1978-1987, by country of first sampling (C1S), in base equivalent of the 4 European countries of evaluation, considering all national proofs (ALP) and only C1S national proofs (FSP), converted proofs (CON) from C1S to European countries, and standard errors (SE) range; values are expressed in kg equivalent to each European country and are <u>not</u> comparable across European country of evaluation.

C1S	European country of evaluation											
	ITA (ITA-kg)			FRA (FRA-kg)			NLD (NLD-kg)			DEU (DEU-kg)		
	ALP	FSP	CON	ALP	FSP	CON	ALP	FSP	CON	ALP	FSP	CON
ITA	9.4	9.2	8.9	.7	2.4		3.4	5.5	4.0	3.8	5.0	4.1
FRA	9.3	7.3		.5	.4	-.1	3.3	4.0	2.5	3.7	3.4	2.8
NLD	7.3	4.5	5.9	-1.6	-2.7	-2.5	1.7	1.7	1.7	2.1	1.1	.8
DEU	5.2	3.5	8.3	-3.9	-3.8	-1.3	-.1	.9	1.8	.3	.3	1.7
USA	17.7	14.0	18.9	9.7	7.7	7.1	10.3	9.5	10.4	10.8	9.0	6.3
SE	.3 -.5			.3 - .6			.1 - .5			.1 - .5		

Values in Tables 16, 17, and 18, are comparable only within column, i.e. within European country. Differences among values indicate average genetic difference in estimated transmitting ability of bulls tested in various countries. As was the case with standardized means (Table 7) the relative ranking of the average merit of these bulls is similar under ALP and FSP, but some pairwise differences are affected.

Generally, in any two-country scenario, the relative rankings of bulls under ALP, FSP, and conversions were similar (within year rank correlations were close to unity). In some cases, mean differences between EC 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 conversion coefficients were excluded from the FSP analysis. In some cases, international proofs of USA bulls under FSP, on the average, turned out lower than ALP and converted proofs e.g. ITA fat and protein, NLD protein. In other cases conversions were not based on the same bulls as ALP (theoretical calculations, indirect conversions) and such comparisons can not be made.

In summary, experiences gained from this project with regards to comparison between the linear model and the conversion method have indicated that the linear model method is preferable for international bull evaluations, on the following grounds:

1) Conversions are often calculated using bull proofs based on imported semen which are likely upwards biased;

2) Some comparisons are based on conversions with direction opposite to the gene flow, which results in additional bias;

3) The linear model approach considers the same, comprehensive data set for a simultaneous comparison.