2.0 PROCEDURES APPLIED AT PRESENT FOR CONVERSION OF SIRE PROOFS

Conversion of sire proofs from exporting countries to the range and scale of an importing country by the IDF formula (IDF, 1981)

converted proof = a + b (proof in exporting country)

is more or less routinely applied by several countries.

The methods to estimate conversion constant **a** and factor **b** were applied to datasets providing progeny test results from bulls in both exporting and importing countries. Table 2.1 gives the methods which were used in more recent applications together with the countries involved.

Factor **b** is derived in most cases as a Least Squares estimator for a regression of proofs in importing countries on native proofs. Modifications were used in some cases to account for an underestimation of the true relationship by the standard Least Squares regression method as pointed out in chapter 3.

Powell (1984), Goddard (1984) and **Wilmink and Wismans (1984)** regressed on a kind of deregressed proof in the importing country which is almost a mean daughter deviation. **Wickham (1984)** averaged the Least Squares regression line b_{yx} and the inverse coefficient b_{xy} which in case of a geometric mean would yield **b** to be the ratio of standard deviations in both countries.

A completely different approach to determine factor **b** was used by **Powell (1984)** where **b** was derived from the relation of units of measurements for sire proofs. Also in this method, however, constant **a** was computed from a sample of bulls with progeny in both countries.

It should be noted from Table 2.1 that base definitions are different in many countries. The constants **a** are often valid only until a new base change. Also it has to be stressed that constants **a** represent the differences between bases rather than the genetic distances between two populations.

The factors **b** do not only reflect different scales (kg, lb, relative breeding value) or definitions (breeding value or transmitting ability) but also account for genetic correlations between countries lower than 1 due to different heritabilities and definitions of traits or inclusion of only first vs. all lactations into a proof.

Although the number of sires with progeny in both countries was relatively small in some cases (Table 2.2), it could be concluded that the correlations of proofs between countries were fairly high. This is an indication that the above mentioned genetic correlation between results obtained in different countries is very high and that genotype by environment interactions do not seem to be important.

Most authors set minimal repeatabilities for sires to be included into the dataset for estimation of conversion factors. It can also be seen from Table 2.2 that the average number of daughters or the regarding mean repeatability was generally high.

From results of **Wilmink and Wismans (1984)** it can be noted that correlations between proofs tend to increase with higher restrictions on minimal repeatability (.85 vs. .75), even though less sires enter the sample.

It has been mentioned already that especially the **a** values, as given in Table 2.3, need to be re-estimated whenever a base change takes place. Estimated factors **b** are often in the expected range when compared to values derived from scales. This can be seen from results of **Powell (1984)**, but also for traits expressed in percent in both countries where **b** derived from scales is 1 or, when predicted differences are converted to breeding values, **b** is expected to be 2. As there are some deviations from these expectations, it should be preferred to estimate **b** whenever a suitable dataset and a reliable estimation procedure is available.

Table 2.1. Methods applied to estimate conversion factors.

author	author code	method for estimation of b	code	countries and base definitions referred to		lactations included in sire proofs
Averdunk, G. and M. Schneeberger (1984)	A	least squares (method 2 in chapter 3)	CH	Switzerland, rolling base		first
			DBY	Bavaria (Germany), rolling		first
			DBW	Baden-Württemberg (Germany), rolling		all
			USA	United States, fixed		all
R. Powell (1984)	B	1. least squares from unregressed MCD (close to method 4) 2. b derived from scale definitions	CDN	Canada fixed (when reported)		first
			USA	fixed (PD 74)		all or first *)
Goddard, M. (1984)	C	least squares from deregressed proofs (method 4)	AUS	Australia	fixed	all
			NZ	New Zealand	fixed	all
Lederer, J.A. (1984)	D	least squares (method 2)	CDN		rolling	first
			DNS	Niedersachsen (Germany)	fixed	all
			USA		fixed	all
Swanson, G. J. T. (1984)	E	least squares (method 2)	AUS		fixed	all
			CDN		rolling	first
			NZ		fixed	all
			UK	United Kingdom	fixed	first
Wickham, B. W. (1984)	F	average of least squares estimators b_{yx} and b_{xy}^{-1}	AUS		fixed	all
			CDN		rolling	first
			NZ		fixed	all
Wilmink, J.B.M. and W.M.G. Wismans	G	least squares from deregressed proofs (close to method 3)	CDN		rolling	first
			DNS		fixed	first*)
			NL	Netherlands	fixed	first
			USA		fixed	all

*) for this analysis only

Table 2.2. Statistics for samples of sire proofs from which conversion factors were derived.

author	breed	countries X	countries Y	traits	no. of sires	$\bar{X}$ (s) X	$\bar{X}$ (s) Y	r_{xy} correlation between proofs	minimal repeatability % X	minimal repeatability % Y	mean repeatability % X	mean repeatability % Y	average no. of daughter/bull X	average no. of daughter/bull Y
A	Brown-vieh / Brown Swiss	USA	CH	milk	34	-378 (728) lb	943 (361)	.84					695	864
				fat		- 13 (29) lb	43 (17)	.81						
				fat %		0.16 (0.22)	0.02 (0.09)	.81						
		USA	DBW	milk	18	-13 (683) lb	641 (298)	.87					616	131
				fat		6 (25) lb	23 (13)	.83						
				fat %		0.05 (0.08)	-0.05 (0.16)	.78						
		USA	DBY	milk	34	-384 (683) lb	540 (346)	.66					900	62
				fat		- 7 (29) lb	29 (19)	.69						
				fat %		.06 (.09)	.14 (.20)	.67						
		CH	DBY	milk	15			.75					1218	1561
				fat				.74						
				fat %				.69						
		DBW	DBY	milk	10			.77					160	2314
				fat				.80						
				fat %				.64						
		DBW	CH	milk	8			.63					115	768
				fat				.67						
				fat %				.96						
B	Holstein	CDN	USA	milk $PD_{1.\ lact.}$	241	4.16 BCA	- 73 kg	.79	≥ 50		89	74		
				milk $PD_{all\ lact.}$			- 65 kg	.77				84		
				milk $MCD_{1.}$			- 84 kg	.77				74		
				milk MCD_{all}			- 79 kg	.77				84		
				fat $PD_{1.}$		3.77 BCA	- 2.9 kg	.82	≥ 50		89	74		
				fat PD_{all}			- 2.8 kg	.81				84		
				fat $MCD_{1.}$			- 3.3 kg	.80				74		
				fat MCD_{all}			- 3.2 kg	.81				84		
C	Holstein	NZ	AUS	fat yield	187	119 (9.32)	0.3 (11.1)		≥ 50		83	84		
				milk		114 (9.1)	-41 (340)							
D	Holstein	USA	DNS	milk	44			.72						
				fat %	44			.82						
				fat	44			.75						
				prot %	42			.85						
				prot	42			.78						
		CDN	DNS	milk	28			.71						
				fat %	28			.94						
				fat	28			.87						
				protein %	25			.88						
				protein	25			.84						

Table 2.2. Continued.

author	breed	countries X	countries Y	traits	no.of sires	$\bar{X}$ (s) X	$\bar{X}$ (s) Y	r_{xy} correlation between proofs	minimal repeatability % X	minimal repeatability % Y	mean repeatability % X	mean repeatability % Y	average no. of daughter/bull X	average no. of daughter/bull Y
E	Holstein	CDN	UK	milk fat protein fat % prot %	27			.84 .93 .89 .91 .86	73	75	97	94		
		AUS	UK	milk fat protein fat % prot %	32			.78 .65 .72 .79 .87	68	71	84	99		
		NZ	UK	milk fat fat %	44			.89 .88 .81	60	77	76	99		
	Ayrshire	NZ	UK	milk fat fat %	13			.95 .95 .88	60	77	70	97		
F	Ayrshire	NZ	UK	milk fat	25				≥50					
	Holstein	AUS	NZ	milk fat	31				≥50					
		CDN	NZ	milk fat	31				≥50					
		UK	NZ	milk fat	33				≥50					
	Jersey	AUS	NZ	milk fat	4				≥50					
G	Holstein	USA	NL	milk fat % prot %	39	-424 .131 .045	1138 -.045 -.072	.82 .92 .93	≥75					
				milk fat % prot %	26	-404 .150 -.005	1148 .008 -.053	.85 .94 .92	≥85					
		CDN	NL	milk fat % prot %	19	-1.534 .050 -.005	.998 -.181 -.141	.84 .90 .91	≥75					
				milk fat % prot %	14	-1.049 .065 .003	1077 -.157 -.131	.86 .92 .91	≥85					
		DNS	NL	milk fat % prot %	29	305 .102 -.069	972 -.073 -.108	.87 .93 .90	≥75					
				milk fat % prot %	22	338 .072 -.088	1057 -.098 -.137	.89 .95 .93	≥85					

Table 2.3. Conversion constants (a) and factors (b).

author	breed	conversion from country to country	trait	a	b
A	Brown Swiss Braunvieh	USA CH	milk	1101	.419
			fat	49.2	.483
			fat %	.13	2.04
		USA DBW	milk	646	.377
			fat	20.7	.424
			fat %	-.11	1.43
		USA DBY	milk	670	.335
			fat	32.2	.452
			fat %	20.7	.427
		CH DBY	milk	-234	.800
			fat	-17.6	.900
			fat %	-.07	.85
		DBY CH	milk	626	.706
			fat	33.1	.573
			fat %	.16	.56
		DBW DBY	milk	-53	1.068
			fat	1.1	1.267
			fat %	.14	.99
		DBY DBW	milk	282	.552
			fat	8.5	.505
			fat %	-.04	.42
		DBW CH	milk	791	.549
			fat	34.8	.652
			fat %	.21	1.23
		CH DBW	milk	-144	.729
			fat	-10.1	.698
			fat %	-.16	.75
B	Holstein	CDN USA b derived by regression	milk $PD_{1.\ lact.}$	-235	39
			PD_{all}	-227	39
			$MCD_{1.}$	-297	51
			MCD_{all}	-270	46
			fat $PD_{1.}$	-8.0	1.35
			PD_{all}	-8.3	1.46
			$MCD_{1.}$	-9.9	1.76
			MCD_{all}	-9.7	1.71
		CDN USA b derived from scales	milk	-300	53
			fat	-10.5	1.96
		USA CDN b derived from scales	milk	5.7	.0189
			fat	5.4	.5102
C	Holstein	NZ AUS	fat	-114.1	.98
			milk	-.3781	33.3

Table 2.3. Continued.

author	breed	conversion from country to country		trait	a	b
D	Holstein	USA	DNS	milk	584	.61
				fat %	-.18	1.96
				fat	14.3	.74
				prot %	-.13	1.83
				protein	12.4	.59
		CDN	DNS	milk	223	45
				fat %	-.09	1.78
				fat	7.0	2.23
				prot %	-.09	2.15
				protein	3.2	1.95
E	Holstein	CDN	UK	milk	612	39.1
				fat	19.3	1.40
				protein	15.1	1,18
				fat %	-.0685	.7937
				prot %	-.0771	.8654
		AUS	UK	milk	-623.63	1.651
				fat	-21.83	1.465
				protein	-19.1	1.511
				fat %	-.0116	1.461
				prot %	.059	1.486
		NZ	UK	milk	-2015.1	20.60
				fat	-82.2	.817
				fat %	-.0378	.0417
	Ayrshire	NZ	UK	milk	-2371.9	23.92
				fat	-96.5	.978
				fat %	-.0027	.457
F	Ayrshire	UK	NZ	milk	98.43	.089
				fat	97.86	1.008
	Holstein	AUS	NZ	milk	114.52	.021
				fat	118.63	.639
		CDN	NZ	milk	125.11	2.066
				fat	126.65	1.946
		UK	NZ	milk	101.49	.041
				fat	103.06	1.057
	Jersey	AUS	NZ	milk	112.41	.034
				fat	119.59	.653
G	Holstein	USA	NL	milk $r^2 \geq$	1379	.60
				fat % .75	-.29	1.96
				prot %	-.15	1.87
				milk $r^2 \geq$	1370	.56
				fat % .85	-.28	2.00
				prot %	-.14	1.86
		CDN	NL	milk $r^2 \geq$	1065	52
				fat % .75	-.26	1.59
				prot %	-.13	2.06
				milk $r^2 \geq$	1128	52
				fat % .85	-.26	1.61
				prot %	-.14	2.09
		DNS	NL	milk $r^2 \geq$	669	1.00
				fat % .75	-.16	.84
				prot %	-.03	1.11
				milk $r^2 \geq$	735	.98
				fat % .85	-.16	.90
				prot %	-.05	1.06