

Introduction

The latest international evaluation for dairy production traits took place as scheduled at the Interbull Centre. Data from thirty-two (32) countries were included in this evaluation.

International genetic evaluations for milk, fat and protein yields of bulls from Australia, Austria-Germany, Belgium, Canada, Czech Republic, Denmark-Finland-Sweden, Estonia, France, Hungary, Ireland, Israel, Italy, Japan, Latvia, Lithuania, Netherlands, New Zealand, Norway, Poland, Republic of South Africa, Slovak Republic, Slovenia, Spain, Switzerland, the United Kingdom, the United States of America, Portugal, Korea, and Uruguay were computed. Brown Swiss, Guernsey, Holstein, Jersey, Red Dairy Cattle and Simmental breed data were included in this evaluation.

Changes in national procedures

Changes in the national genetic evaluation of production traits are as follows:

FRA (ALL)	Base change. HOL/SIM/MON: French and Montbeliard breeding organisations have made the choice to suspend the publication of EBVs for bulls that entered progeny testing and produced daughters but were not subsequently placed on the market as public breeding bulls based on their progeny test results. As consequence, around 1000 bulls are now missing or their publication status have changed from official to unofficial
ITA (HOL, JER)	Base change, HOL: Applied a yearly cutoff of data causing some bulls to be missings
IRL (ALL)	Minor change in data edits where individual milk records where the sire is unknown, are excluded from the evaluation unless the cow has at least 3 tests within a given lactation. Pedigree verification
POL (HOL)	New definition of UPG groups, pedigree pruning, new genetic base, applied new coding for status and type of proof according to new recommendation from Interbull Centre. Added filtering requiring cows to have records in first lactation, removal of records from small CG or CG without any phenotypic variation, causing drops in reliability
AUS (ALL)	Decrease in information due to pedigree updates and change in status of some bulls that do not qualify for inclusion any longer.
DFS (ALL)	Drops in information due to data edits
CAN (ALL)	Base change
ISR (ALL)	Small reduction on Herds/daughters/EDC due to corrections in pedigree.
EST (ALL)	New genetic base: cows born in years 2018-2022 are now considered, updated definition of herd (dairy groups within big cowbarns of some owners have different herd code), causing drops in EDC due to daughters of bull having smaller number of herdmates in the new herds.
USA (ALL)	Drops in herds/daughters/EDC are related to pedigree correctness and daughter-herd-year minimum edits.
DEU (ALL)	Base change
JPN (HOL)	Base change
CHE (ALL)	Base change, drops in information due to manual edits
GBR (ALL)	Base change
SVN (ALL)	Base change, estimated variance components and heritability for all traits. HOL/SIM: Time period for data inclusion has been shifted forward by five years (data from 2015 to 2025 are used).
BEL (HOL)	Slight drops in information due to pedigree verification causing 8 bulls to be missing as no longer qualifying
DEA (ALL)	Slight dropd in information due to pedigree verification
ITA (BSW)	Base change
NZL (ALL)	Pedigree verification causing slight change in information and reliability
ESP (HOL)	Base change
NLD (ALL)	Base change. Minor change in EDC calculation leading to a small drop in EDC.
LTU (ALL)	Base change
PRT (HOL)	The Pedigree was updated, some parents were removed due to lab results. Adopted the new classification of type of proofs as recommended by the Interbull.

A new document called confdoc_DEFINITION{runid}.itb has been introduced reporting all the trait definitions applied by countries as reported in the PREP.

Direct Gestation Length (ges) has been added as the fifth trait in the calving evaluation starting from the August 2025 MACE routine evaluation, and therefore added in the calv{BRD}{RUNID}.itb and calv{BRD}{RUNID}.ipr.

During 2023-2024, Interbull Centre and the Interbull Technical Committee (ITC) have worked on developing a new procedures for adjusting of the international correlations after a given test run in case countries would decide NOT TO implement the changes tested in the next routine run. Until now, the relative difference between the previous routine's and test run's correlations, for each pair of countries, was assessed and the average value of the two was used whenever such difference did exceed a threshold of 0.01. Otherwise, correlations from the latest test run were used. However, in some cases, the difference in correlations between routine/test runs were way above a 1% difference so that by using the average value the newly derived correlations would still be greatly affected by the changes tested but not implemented. This remark has been made in few occasions by some participating countries. A new approach proposed by Peter Sullivan, was developed and extensively tested. The new approach is based on first identifying the relative impact of the changes tested by a country during the test run (but not implemented in a routine run) and then correcting the whole correlation matrix detracting such estimated impact. This new approach would assure that the new correlations would be free from any effect from any changes tested but not implemented. The new procedure has been fully developed during 2023 and extensively tested during 2024 and introduced officially in the April 2025 routine evaluation.

DATA AND METHOD OF ANALYSIS

Data were national genetic evaluations of AI sampled bulls with at least 10 daughters or 10 EDC (for clinical mastitis and maternal calving traits at least 50 daughters or 50 EDC, and for direct calving traits at least 50 calvings or 50 EDC) in at least 10 herds. Table 1 presents the amount of data included in this Interbull evaluation for all breeds.

National proofs were first de-regressed within country and then analysed jointly with a linear model including the effects of evaluation country, genetic group of bull and bull merit. Heritability estimates used in both the de-regression and international evaluation were as in each country's national evaluation.

Table 2 presents the date of evaluation as supplied by each country

Estimated genetic parameters and sire standard deviations are shown in APPENDIX I and the corresponding number of common bulls are listed in APPENDIX II.

SCIENTIFIC LITERATURE

The international genetic evaluation procedure is based on international work described in the following scientific publications:

International genetic evaluation computation:
Schaeffer. 1994. J. Dairy Sci. 77:2671-2678
Klei, 1998. Interbull Bulletin 17:3-7

Verification and Genetic trend validation:
Klei et al., 2002. Interbull Bulletin 29:178-182.
Boichard et al., 1995. J. Dairy Sci. 78:431-437

Weighting factors:
Fikse and Banos, 2001. J. Dairy Sci. 84:1759-1767

De-regression:
Sigurdsson and G. Banos. 1995. Acta Agric. Scand. 45:207-219
Jairath et al. 1998. J. Dairy Sci. Vol. 81:550-562

Genetic parameter estimation:
Klei and Weigel, 1998, Interbull Bulletin 17:8-14
Sullivan, 1999. Interbull Bulletin 22:146-148

Post-processing of estimated genetic correlations:
Mark et al., 2003, Interbull Bulletin 30:126-135
Jorjani et al., 2003. J. Dairy Sci. 86:677-679
<https://wiki.interbull.org/public/rG%20procedure?action=print>

Time edits
Weigel and Banos. 1997. J. Dairy Sci. 80:3425-3430

International reliability estimation

NEXT ROUTINE INTERNATIONAL EVALUATION

 Dates for the next routine evaluation can be found on
<https://interbull.org/ib/servicecalendar>

NEXT TEST INTERNATIONAL EVALUATION

 Dates for the next test run can be found on
<https://interbull.org/ib/servicecalendar>

From 2025 an extra MACE test run has been scheduled in May, data submissions' deadline and target for distribution of results are all reported in the above link.

PUBLICATION OF INTERBULL ROUTINE RUN

 Results were distributed by the Interbull Centre to designated representatives in each country. The international evaluation file comprised international proofs expressed on the base and unit of each country included in the analysis. Such records readily provide more information on bull performance in various countries, thereby minimizing the need to resort to conversions.

At the same time, all recipients of Interbull results are expected to honor the agreed code of practice, decided by the Interbull Steering Committee, and only publish international evaluations on their own country scale. Evaluations expressed on another country scale are confidential and may only be used internally for research and review purposes.

PUBLICATION OF INTERBULL TEST RUN

 Test evaluation results are meant for review purposes only and should not be published.

^LTable 1. National evaluation data considered in the Interbull evaluation for dairy production traits (April Routine Evaluation 2026).
 Number of records for milk yield by breed

Country	BSW	GUE	HOL	JER	RDC	SIM
AUS	239	156	9199	1962	892	
BEL			2492			
CAN	301	116	14642	964	915	
CHE	3369		3606	110		3858
CZE			4840			
DEA	6688					29326
DEU			25460	339	324	
DFS			14974	2451	8209	
ESP			4999			
EST			1672		520	
FRA	534		19133			525
FRM						5403
GBR	214	390	8784	1074	785	123
HUN			3370			
IRL			3621	163	62	106
ISR			1933			
ITA	2521		9173	172		
JPN			7354			
KOR			1955			
LTU			1041		393	
LVA			1532		682	
NLD	282		17809	321	114	585

NOR					4488		
NZL	100	65	9820	5960	1625		
POL			14595				
PRT			3788				
SVK			1263				
SVN	381		727			670	
URY			1254				
USA	1285	856	44482	5824	857	125	
ZAF			1318	766	145		
CAM					51		
=====							
No.Records	15914	1583	234836	20106	20062	40721	
Pub. Proofs	12432	1245	163183	15750	17517	37149	

^LAPPENDIX I. Sire standard deviations in diagonal and genetic correlations below diagonal

BSW mil

	CAN	FRA	USA	CHE	ITA	DEA	NLD	SVN	NZL	GBR	AUS
CAN	639.16										
FRA	0.90	659.38									
USA	0.91	0.90	683.98								
CHE	0.90	0.91	0.86	474.44							
ITA	0.86	0.83	0.86	0.87	629.29						
DEA	0.81	0.85	0.82	0.92	0.89	469.52					
NLD	0.88	0.86	0.84	0.84	0.84	0.87	682.10				
SVN	0.69	0.74	0.69	0.71	0.63	0.68	0.67	10.47			
NZL	0.68	0.77	0.71	0.73	0.68	0.72	0.70	0.65	467.95		
GBR	0.82	0.85	0.81	0.82	0.76	0.74	0.81	0.66	0.72	299.62	
AUS	0.73	0.77	0.72	0.70	0.64	0.63	0.70	0.65	0.83	0.70	379.86

BSW fat

	CAN	FRA	USA	CHE	ITA	DEA	NLD	SVN	NZL	GBR	AUS
CAN	26.85										
FRA	0.88	27.49									
USA	0.89	0.90	24.46								
CHE	0.87	0.90	0.82	18.71							
ITA	0.86	0.86	0.85	0.88	23.80						
DEA	0.80	0.87	0.81	0.93	0.88	17.38					
NLD	0.85	0.84	0.81	0.81	0.81	0.84	26.03				
SVN	0.74	0.79	0.73	0.72	0.70	0.75	0.67	10.71			
NZL	0.71	0.78	0.74	0.79	0.69	0.78	0.67	0.67	22.54		
GBR	0.83	0.85	0.81	0.80	0.76	0.74	0.81	0.67	0.71	9.79	
AUS	0.72	0.71	0.75	0.64	0.64	0.65	0.66	0.62	0.79	0.66	15.56

BSW pro

	CAN	FRA	USA	CHE	ITA	DEA	NLD	SVN	NZL	GBR	AUS
CAN	23.10										
FRA	0.85	21.70									
USA	0.88	0.87	20.98								
CHE	0.84	0.86	0.83	15.17							
ITA	0.81	0.81	0.82	0.86	22.10						
DEA	0.76	0.81	0.79	0.92	0.87	14.62					
NLD	0.84	0.81	0.79	0.80	0.79	0.83	22.06				
SVN	0.66	0.71	0.66	0.65	0.63	0.66	0.63	10.02			
NZL	0.61	0.70	0.65	0.69	0.63	0.65	0.60	0.59	16.51		
GBR	0.82	0.80	0.77	0.77	0.72	0.68	0.80	0.64	0.65	8.31	
AUS	0.68	0.68	0.67	0.59	0.56	0.54	0.59	0.56	0.78	0.62	12.05

GUE mil

DFS	0.89	0.89	0.85	0.71	0.68	0.78	10.69										
DEU	0.92	0.83	0.91	0.70	0.71	0.86	0.91	27.45									
ZAF	0.75	0.78	0.80	0.63	0.63	0.64	0.71	0.68	20.52								
EST	0.86	0.75	0.86	0.68	0.72	0.78	0.83	0.86	0.73	21.55							
LVA	0.74	0.65	0.77	0.64	0.63	0.70	0.68	0.78	0.72	0.82	14.84						
LTU	0.69	0.65	0.74	0.60	0.64	0.63	0.69	0.72	0.69	0.72	0.73	18.52					
IRL	0.81	0.72	0.78	0.81	0.79	0.76	0.80	0.80	0.64	0.78	0.64	0.63	7.41				
NLD	0.89	0.85	0.86	0.67	0.69	0.84	0.89	0.92	0.67	0.80	0.72	0.67	0.80	29.49			
CAM	0.80	0.79	0.93	0.68	0.68	0.78	0.79	0.79	0.80	0.79	0.77	0.78	0.76	0.79	21.41		

RDC pro

	CAN	NOR	USA	NZL	AUS	GBR	DFS	DEU	ZAF	EST	LVA	LTU	IRL	NLD	CAM
CAN	18.63														
NOR	0.82	12.21													
USA	0.89	0.85	20.94												
NZL	0.59	0.68	0.63	11.58											
AUS	0.62	0.63	0.65	0.76	12.27										
GBR	0.80	0.77	0.78	0.61	0.67	7.32									
DFS	0.87	0.88	0.84	0.65	0.61	0.75	10.60								
DEU	0.90	0.80	0.88	0.62	0.62	0.83	0.91	20.55							
ZAF	0.76	0.77	0.77	0.66	0.73	0.64	0.70	0.69	17.45						
EST	0.80	0.79	0.78	0.63	0.71	0.79	0.79	0.66	17.05						
LVA	0.72	0.67	0.74	0.57	0.55	0.68	0.64	0.72	0.69	0.72	9.66				
LTU	0.66	0.62	0.68	0.52	0.57	0.61	0.60	0.68	0.68	0.62	0.65	11.81			
IRL	0.74	0.74	0.74	0.78	0.77	0.73	0.74	0.75	0.67	0.66	0.62	0.56	5.41		
NLD	0.87	0.90	0.83	0.60	0.61	0.80	0.87	0.90	0.68	0.74	0.67	0.63	0.75	25.20	
CAM	0.78	0.79	0.90	0.71	0.68	0.77	0.77	0.78	0.78	0.77	0.76	0.76	0.73	0.76	9.98

SIM mil

	CHE	DEA	FRM	SVN	FRA	NLD	IRL	GBR	USA
CHE	565.09								
DEA	0.87	498.35							
FRM	0.94	0.86	619.08						
SVN	0.77	0.80	0.80	10.28					
FRA	0.90	0.92	0.84	0.76	696.78				
NLD	0.88	0.92	0.88	0.77	0.89	761.97			
IRL	0.84	0.71	0.85	0.74	0.86	0.80	183.45		
GBR	0.86	0.85	0.85	0.70	0.85	0.84	0.77	246.40	
USA	0.87	0.83	0.84	0.78	0.90	0.88	0.80	0.82	641.70

SIM fat

	CHE	DEA	FRM	SVN	FRA	NLD	IRL	GBR	USA
CHE	22.62								
DEA	0.88	18.75							
FRM	0.93	0.89	24.10						
SVN	0.74	0.80	0.80	10.29					
FRA	0.89	0.93	0.84	0.76	28.38				
NLD	0.86	0.91	0.89	0.78	0.88	29.22			
IRL	0.79	0.67	0.78	0.72	0.82	0.76	7.63		
GBR	0.88	0.83	0.83	0.70	0.87	0.84	0.74	8.72	
USA	0.84	0.82	0.84	0.75	0.90	0.86	0.78	0.84	21.85

SIM pro

	CHE	DEA	FRM	SVN	FRA	NLD	IRL	GBR	USA
CHE	16.94								
DEA	0.86	15.27							
FRM	0.93	0.85	19.96						
SVN	0.74	0.74	0.80	10.17					
FRA	0.88	0.90	0.78	0.67	22.64				
NLD	0.83	0.90	0.86	0.73	0.84	24.40			
IRL	0.79	0.67	0.80	0.70	0.79	0.74	6.37		

GBR	0.83	0.81	0.81	0.67	0.83	0.82	0.72	7.53		
USA	0.83	0.77	0.78	0.73	0.87	0.83	0.74	0.80	18.32	

^LAPPENDIX II. Number of common bulls

BSW mil

common bulls below diagonal											
common	three	quarter	sib	group	above diagonal						
	CAN	FRA	USA	CHE	ITA	DEA	NLD	SVN	NZL	GBR	AUS
CAN	0	102	213	164	162	180	65	41	43	92	112
FRA	92	0	142	212	250	280	111	61	40	95	83
USA	209	104	0	349	278	378	108	49	57	129	144
CHE	141	168	327	0	576	720	137	98	50	109	134
ITA	144	210	204	518	0	891	170	116	59	123	142
DEA	158	227	346	612	789	0	199	131	72	126	152
NLD	60	96	100	126	146	189	0	59	44	72	77
SVN	36	58	39	93	108	118	59	0	18	40	30
NZL	42	29	49	37	48	65	37	16	0	39	47
GBR	86	88	120	86	95	89	64	33	35	0	82
AUS	114	67	135	94	107	114	60	22	37	72	0

BSW fat

common bulls below diagonal											
common	three	quarter	sib	group	above diagonal						
	CAN	FRA	USA	CHE	ITA	DEA	NLD	SVN	NZL	GBR	AUS
CAN	0	102	213	164	162	180	65	41	43	92	112
FRA	92	0	142	212	250	280	111	61	40	95	83
USA	209	104	0	349	278	378	108	49	57	129	144
CHE	141	168	327	0	576	721	137	98	50	109	134
ITA	144	210	204	518	0	891	170	116	59	123	142
DEA	158	227	346	612	789	0	199	131	72	126	152
NLD	60	96	100	126	146	189	0	59	44	72	77
SVN	36	58	39	93	108	118	59	0	18	40	30
NZL	42	29	49	37	48	65	37	16	0	39	47
GBR	86	88	120	86	95	89	64	33	35	0	82
AUS	114	67	135	94	107	114	60	22	37	72	0

BSW pro

common bulls below diagonal											
common	three	quarter	sib	group	above diagonal						
	CAN	FRA	USA	CHE	ITA	DEA	NLD	SVN	NZL	GBR	AUS
CAN	0	102	213	164	162	180	65	41	43	92	112
FRA	92	0	142	212	250	280	111	61	40	95	83
USA	209	104	0	349	278	378	108	49	57	129	144
CHE	141	168	327	0	576	721	137	98	50	109	134
ITA	144	210	204	518	0	891	170	116	59	123	142
DEA	158	227	346	612	789	0	199	131	72	126	152
NLD	60	96	100	126	146	189	0	59	44	72	77
SVN	36	58	39	93	108	118	59	0	18	40	30
NZL	42	29	49	37	48	65	37	16	0	39	47
GBR	86	88	120	86	95	89	64	33	35	0	82
AUS	114	67	135	94	107	114	60	22	37	72	0

GUE mil

common bulls below diagonal					
common	three	quarter	sib	group	above diagonal
	CAN	USA	AUS	GBR	NZL
CAN	0	84	59	41	14
USA	76	0	78	105	33
AUS	56	75	0	50	27

GBR	35	106	43	0	17
NZL	11	30	27	15	0

GUE fat

common bulls below diagonal
 common three quarter sib group above diagonal
 CAN USA AUS GBR NZL

CAN	0	84	59	41	14
USA	76	0	78	105	33
AUS	56	75	0	50	27
GBR	35	106	43	0	17
NZL	11	30	27	15	0

GUE pro

common bulls below diagonal
 common three quarter sib group above diagonal
 CAN USA AUS GBR NZL

CAN	0	84	59	41	14
USA	76	0	78	105	33
AUS	56	75	0	50	27
GBR	35	106	43	0	17
NZL	11	30	27	15	0

HOL mil

common bulls below diagonal
 common three quarter sib group above diagonal
 CAN DEU DFS FRA ITA NLD USA CHE GBR NZL AUS BEL IRL ESP CZE SVN EST ISR HUN POL ZAF JPN LVA SVK LTU PRT KOR URY

CAN	0	2920	1952	1816	2067	2058	4464	1041	2132	969	1765	1001	682	1586	1320	230	438	205	1254	2115	517	1569	617	496	353	1519	922	561
DEU	2412	0	3295	2905	2786	4110	4177	1331	2513	1205	1938	1502	994	1850	2105	393	664	223	1501	3821	562	1602	897	760	643	1815	798	535
DFS	1784	2633	0	2035	1767	2737	2705	867	1909	1050	1553	1106	850	1315	1445	283	514	203	1126	2544	517	1164	590	469	427	1422	655	471
FRA	1396	1872	1332	0	1658	2434	2847	846	1826	953	1495	1185	822	1492	1370	221	359	157	1093	2413	515	1346	516	490	317	1360	675	465
ITA	1880	2185	1554	1150	0	1944	2953	782	1676	684	1186	867	559	1396	1378	287	422	183	1185	2355	335	1160	600	399	392	1284	695	386
NLD	2039	3971	2498	1780	1788	0	3157	1069	2197	1334	1735	1565	1028	1424	1743	303	569	218	1189	2829	526	1268	628	612	441	1576	666	490
USA	5155	3326	2271	1745	2586	2901	0	1167	2835	1381	2338	1181	941	1873	1966	261	566	348	1619	3222	649	2227	849	633	478	1940	1118	781
CHE	967	1270	823	792	717	1069	1102	0	855	495	733	707	457	655	534	146	229	76	485	881	259	540	290	258	151	668	342	235
GBR	2409	2018	1531	1292	1428	1998	2673	819	0	1168	1711	1046	1213	1273	1188	210	407	198	1025	2005	521	1201	524	424	379	1306	645	517
NZL	955	949	776	639	555	1222	1336	416	1023	0	1420	624	862	651	673	127	215	151	572	960	379	667	303	287	218	762	396	434
AUS	1808	1524	1188	1085	982	1547	2421	651	1520	1426	0	878	823	1055	912	168	311	151	839	1459	488	1031	464	346	293	1101	584	505
BEL	1005	1552	1048	1226	877	1786	1073	721	1041	514	782	0	588	814	719	174	265	105	631	1174	342	638	343	334	212	917	392	282
IRL	641	870	702	694	489	966	862	462	1244	756	708	569	0	564	511	105	174	128	477	823	333	490	237	227	172	635	292	310
ESP	1131	1261	1058	1254	1052	1298	1334	550	1012	500	778	801	529	0	961	195	285	136	917	1597	455	1036	436	356	275	1176	618	402
CZE	1010	1674	1027	910	1093	1550	1620	376	808	470	605	558	359	651	0	225	378	167	1046	1802	345	923	487	481	350	1035	569	372
SVN	178	389	231	170	256	268	210	108	154	89	119	139	81	141	163	0	105	51	171	337	54	162	116	77	88	186	113	55
EST	320	522	375	208	290	436	452	143	265	117	178	175	89	145	246	63	0	81	294	572	115	266	215	150	134	306	168	136
ISR	146	169	149	95	128	171	345	43	148	118	98	66	99	82	130	34	44	0	144	246	68	148	96	62	75	152	86	87
HUN	1202	1250	953	828	1074	1027	1628	403	880	430	639	550	402	749	935	129	186	97	0	1364	379	814	439	357	300	987	562	392
POL	1976	3914	2320	1950	2164	2846	3318	800	1875	790	1195	1167	735	1332	1608	305	453	204	1297	0	473	1286	827	573	527	1703	784	506
ZAF	480	440	397	409	264	447	636	221	456	313	430	294	298	409	222	38	57	43	304	387	0	433	168	184	106	477	279	281
JPN	876	789	683	552	652	731	1105	366	652	367	600	426	313	530	461	91	112	71	466	752	284	0	431	337	258	916	685	428
LVA	403	735	377	282	384	435	755	154	306	170	240	207	135	238	322	68	121	65	324	713	94	192	0	178	225	533	301	213
SVK	346	569	256	278	248	438	436	132	247	170	174	205	110	183	381	35	64	26	250	435	101	124	85	0	117	404	231	196
LTU	223	601	272	146	225	291	356	67	224	114	146	111	91	121	237	41	69	40	197	432	41	97	152	53	0	293	178	139
PRT	1567	1761	1345	1326	1246	1627	2056	619	1214	627	937	951	573	1191	876	146	212	101	986	1847	428	564	435	273	192	0	637	451
KOR	891	572	492	430	571	496	1270	244	476	287	428	292	205	456	409	74	82	45	446	661	209	424	182	138	83	547	0	335
URY	560	410	348	321	304	399	973	188	444	359	407	219	258	325	277	34	81	50	332	446	242	268	125	123	79	407	270	0

HOL fat

common bulls below diagonal
 common three quarter sib group above diagonal
 CAN DEU DFS FRA ITA NLD USA CHE GBR NZL AUS BEL IRL ESP CZE SVN EST ISR HUN POL ZAF JPN LVA SVK LTU PRT KOR URY

CAN	0	2920	1951	1816	2071	2058	4461	1041	2132	969	1765	1001	682	1585	1320	230	438	205	1254	2115	516	1564	617	496	353	1517	922	561
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DEU	2412	0	3295	2905	2789	4110	4174	1331	2512	1205	1938	1502	994	1850	2105	393	664	223	1501	3821	561	1597	897	760	643	1812	798	535
DFS	1784	2633	0	2035	1769	2737	2702	867	1909	1050	1553	1106	849	1314	1444	283	514	203	1125	2543	516	1161	590	469	427	1420	655	471
FRA	1396	1872	1332	0	1662	2434	2846	846	1826	953	1495	1185	823	1492	1370	221	359	157	1093	2413	514	1343	516	490	317	1357	675	465
ITA	1885	2191	1558	1153	0	1947	2956	784	1680	686	1190	870	561	1398	1379	287	423	183	1187	2359	337	1161	601	400	392	1286	696	388
NLD	2039	3971	2498	1780	1792	0	3155	1069	2197	1334	1735	1565	1030	1424	1743	303	569	218	1189	2829	525	1263	628	612	441	1574	666	490
USA	5152	3323	2268	1744	2591	2900	0	1167	2834	1380	2338	1180	940	1871	1965	261	565	348	1618	3221	648	2222	848	633	478	1935	1118	781
CHE	967	1270	823	792	718	1069	1102	0	855	495	733	707	457	655	534	146	229	76	485	881	258	537	290	258	151	668	342	235
GBR	2409	2018	1531	1292	1434	1998	2672	819	0	1168	1711	1046	1214	1273	1188	210	407	198	1025	2005	520	1196	524	424	379	1305	645	517
NZL	955	949	776	639	556	1222	1335	416	1023	0	1420	624	863	651	673	127	215	151	572	960	378	667	303	287	218	762	396	434
AUS	1808	1524	1188	1085	985	1547	2420	651	1520	1426	0	878	823	1055	912	168	311	151	839	1459	487	1028	464	346	293	1101	584	505
BEL	1005	1552	1048	1226	880	1786	1072	721	1041	514	782	0	588	814	719	174	265	105	631	1174	341	637	343	334	212	916	392	282
IRL	641	870	702	694	491	968	862	462	1245	757	708	569	0	563	511	105	174	128	477	824	333	488	237	227	172	635	292	310
ESP	1131	1261	1057	1254	1055	1298	1331	550	1012	500	778	801	529	0	960	195	285	136	916	1596	454	1034	436	356	275	1175	618	402
CZE	1010	1674	1027	910	1093	1550	1619	376	808	470	605	558	359	651	0	225	378	167	1046	1802	344	922	487	481	350	1033	569	372
SVN	178	389	231	170	256	268	210	108	154	89	119	139	81	141	163	0	105	51	171	337	53	162	116	77	88	186	113	55
EST	320	522	375	208	291	436	451	143	265	117	178	175	89	145	246	63	0	81	294	572	115	262	215	150	134	305	168	136
ISR	146	169	149	95	128	171	345	43	148	118	98	66	99	82	130	34	44	0	144	246	67	146	96	62	75	152	86	87
HUN	1202	1250	952	828	1077	1027	1626	403	880	430	639	550	402	748	935	129	186	97	0	1364	378	812	439	357	300	986	562	392
POL	1976	3914	2320	1950	2167	2846	3315	800	1875	790	1195	1167	735	1332	1608	305	453	204	1297	0	472	1280	827	573	527	1701	784	506
ZAF	479	439	396	408	266	446	635	220	455	313	429	294	298	408	221	37	57	43	303	386	0	431	167	183	105	476	278	280
JPN	869	784	680	548	654	726	1096	363	646	366	594	424	311	527	460	91	108	69	464	746	283	0	430	336	258	910	684	427
LVA	403	735	377	282	384	435	754	154	306	170	240	207	135	238	322	68	121	65	324	713	94	191	0	178	225	533	301	213
SVK	346	569	256	278	248	438	436	132	247	170	174	205	110	183	381	35	64	26	250	435	101	123	85	0	117	404	231	196
LTU	223	601	272	146	225	291	356	67	224	114	146	111	91	121	237	41	69	40	197	432	40	97	152	53	0	293	178	139
PRT	1565	1760	1343	1324	1249	1625	2053	619	1213	627	937	950	573	1190	875	146	212	101	986	1846	427	559	435	273	192	0	636	451
KOR	891	572	492	430	572	496	1268	244	476	287	428	292	205	456	409	74	82	45	446	661	209	421	182	138	83	547	0	335
URY	560	410	348	321	305	399	973	188	444	359	407	219	258	325	277	34	81	50	332	446	242	265	125	123	79	407	270	0

HOL pro

common bulls below diagonal																												
common three quarter sib group above diagonal																												
	CAN	DEU	DFS	FRA	ITA	NLD	USA	CHE	GBR	NZL	AUS	BEL	IRL	ESP	CZE	SVN	EST	ISR	HUN	POL	ZAF	JPN	LVA	SVK	LTU	PRT	KOR	URY
CAN	0	2920	1951	1816	2067	2058	4455	1041	2132	969	1765	1001	682	1585	1320	230	438	205	1254	2115	516	1561	617	496	353	1518	922	561
DEU	2412	0	3295	2905	2786	4110	4172	1331	2513	1205	1938	1502	994	1850	2105	393	664	223	1501	3821	561	1595	897	760	643	1815	798	535
DFS	1784	2633	0	2035	1766	2736	2700	867	1910	1050	1553	1106	849	1314	1444	283	514	203	1125	2543	516	1159	590	469	427	1422	655	471
FRA	1396	1872	1332	0	1658	2434	2845	846	1827	953	1495	1185	823	1492	1370	221	359	157	1093	2413	514	1342	516	490	317	1360	675	465
ITA	1880	2185	1554	1150	0	1943	2952	782	1677	684	1186	867	559	1395	1378	287	422	183	1185	2355	334	1156	600	399	392	1284	695	386
NLD	2039	3971	2497	1780	1787	0	3154	1069	2198	1334	1735	1565	1030	1424	1743	303	569	218	1189	2829	525	1260	628	612	441	1576	666	490
USA	5149	3323	2268	1744	2585	2900	0	1167	2833	1380	2335	1179	940	1870	1965	261	565	348	1618	3221	648	2217	848	632	478	1938	1119	781
CHE	967	1270	823	792	717	1069	1101	0	855	495	733	707	457	655	534	146	229	76	485	881	258	535	290	258	151	668	342	235
GBR	2409	2020	1533	1294	1429	2000	2672	819	0	1169	1711	1047	1215	1274	1188	210	407	198	1025	2006	520	1195	524	424	379	1306	645	517
NZL	955	949	776	639	555	1222	1335	416	1023	0	1420	624	863	651	673	127	215	151	572	960	378	667	303	287	218	762	396	434
AUS	1808	1524	1188	1085	982	1547	2419	651	1520	1426	0	878	823	1055	912	168	311	151	839	1459	487	1027	464	346	293	1101	584	505
BEL	1005	1552	1048	1226	877	1786	1071	721	1042	514	782	0	588	814	719	174	265	105	631	1174	341	636	343	334	212	917	392	282
IRL	641	870	702	694	489	968	862	462	1247	757	708	569	0	563	511	105	174	128	477	824	333	487	237	227	172	635	292	310
ESP	1131	1261	1057	1254	1052	1298	1331	550	1013	500	778	801	529	0	960	195	285	136	916	1596	454	1033	436	356	275	1176	618	402
CZE	1010	1674	1027	910	1093	1550	1619	376	809	470	605	558	359	651	0	225	378	167	1046	1802	344	921	487	481	350	1035	569	372
SVN	178	389	231	170	256	268	210	108	154	89	119	139	81	141	163	0	105	51	171	337	53	162	116	77	88	186	113	55
EST	320	522	375	208	290	436	451	143	265	117	178	175	89	145	246	63	0	81	294	572	115	261	215	150	134	306	168	136
ISR	146	169	149	95	128	171	345	43	148	118	98	66	99	82	130	34	44	0	144	246	67	146	96	62	75	152	86	87
HUN	1202	1250	952	828	1074	1027	1626	403	880	430	639	550	402	748	935	129	186	97	0	1364	378	812	439	357	300	987	562	392
POL	1976	3914	2320	1950	2164	2846	3315	800	1877	790	1195	1167	735	1332	1608	305	453	204	1297	0	472	1278	827	573	527	1703	784	506
ZAF	479	439	396	408	263	446	635	220	455	313	429	294	298	408	221	37	57	43	303	386	0	431	167	183	105	476	278	280
JPN	867	783	680	548	649	724	1093	363	647	366	594	424	311	527	460	91	107	69	464	746	283	0	429	336	257	911	683	427
LVA	403	735	377	282	384	435	754	154	307	170	240	207	135	238	322	68	121	65	324	713	94	190	0	178	225	533	301	213
SVK	346	569	256	278	248	43																						

CAN	0	172	564	241	315	215	68	174	70	119	9	49
DFS	169	0	272	218	193	231	210	173	109	219	37	66
USA	598	259	0	473	574	304	143	334	100	201	39	82
NZL	250	199	550	0	536	288	122	231	86	130	106	62
AUS	321	166	619	591	0	275	92	264	84	117	53	64
GBR	210	220	324	291	268	0	126	188	104	145	68	80
NLD	61	214	148	117	82	118	0	90	56	154	27	45
ZAF	170	155	347	238	247	187	86	0	90	101	34	60
ITA	67	110	107	85	79	105	57	83	0	60	19	45
DEU	115	217	199	122	108	139	151	98	61	0	21	56
IRL	6	33	40	118	50	72	25	34	18	21	0	18
CHE	43	66	83	53	54	75	38	53	44	52	13	0

JER fat

common bulls below diagonal												
common three quarter sib group above diagonal												
	CAN	DFS	USA	NZL	AUS	GBR	NLD	ZAF	ITA	DEU	IRL	CHE
CAN	0	172	564	241	315	215	68	174	70	119	9	49
DFS	169	0	272	218	193	231	210	173	109	219	37	66
USA	597	259	0	473	574	303	143	332	100	201	39	82
NZL	250	199	550	0	536	288	122	231	86	130	106	63
AUS	321	166	619	591	0	275	92	264	84	117	53	64
GBR	210	220	323	291	268	0	126	188	104	145	68	80
NLD	61	214	148	117	82	118	0	90	56	154	27	45
ZAF	170	155	345	238	247	187	86	0	90	101	34	60
ITA	67	110	107	85	79	105	57	83	0	60	19	45
DEU	115	217	199	122	108	139	151	98	61	0	21	56
IRL	6	33	40	118	50	72	25	34	18	21	0	18
CHE	43	66	83	53	54	75	38	53	44	52	13	0

JER pro

common bulls below diagonal												
common three quarter sib group above diagonal												
	CAN	DFS	USA	NZL	AUS	GBR	NLD	ZAF	ITA	DEU	IRL	CHE
CAN	0	172	564	241	315	215	68	174	70	119	9	49
DFS	169	0	272	218	193	231	210	173	109	219	37	66
USA	597	259	0	473	574	305	143	332	100	201	39	82
NZL	250	199	550	0	536	289	122	231	86	130	106	62
AUS	321	166	619	591	0	276	92	264	84	117	53	64
GBR	211	221	326	293	269	0	126	188	104	145	68	80
NLD	61	214	148	117	82	118	0	90	56	154	27	45
ZAF	170	155	345	238	247	187	86	0	90	101	34	60
ITA	67	110	107	85	79	105	57	83	0	60	19	45
DEU	115	217	199	122	108	139	151	98	61	0	21	56
IRL	6	33	40	118	50	72	25	34	18	21	0	18
CHE	43	66	83	53	54	75	38	53	44	52	13	0

RDC mil

common bulls below diagonal															
common three quarter sib group above diagonal															
	CAN	NOR	USA	NZL	AUS	GBR	DFS	DEU	ZAF	EST	LVA	LTU	IRL	NLD	CAM
CAN	0	8	240	105	115	107	218	14	75	3	10	22	3	7	0
NOR	7	0	93	64	89	97	158	21	0	40	22	28	49	58	0
USA	226	94	0	151	166	150	245	32	64	34	28	44	25	55	32
NZL	106	63	150	0	185	110	230	27	39	27	22	32	11	34	13
AUS	115	78	168	185	0	116	234	49	38	55	41	50	15	52	15
GBR	104	101	141	106	113	0	148	16	43	19	17	31	19	50	0
DFS	226	133	242	227	207	141	0	75	53	166	136	114	15	67	0
DEU	13	20	30	26	48	16	66	0	1	37	39	27	5	22	0
ZAF	77	0	58	34	39	37	50	1	0	0	2	5	2	2	0
EST	2	39	32	25	49	17	153	36	0	0	55	28	0	32	0
LVA	10	20	25	18	37	16	94	32	2	47	0	48	3	19	0
LTU	21	25	39	30	47	29	101	27	5	27	43	0	6	21	0

IRL	3	48	25	11	14	18	12	5	2	0	3	6	0	10	0
NLD	7	57	54	33	50	49	64	21	2	31	18	20	10	0	0
CAM	0	0	32	13	15	0	0	0	0	0	0	0	0	0	0

RDC fat

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	NOR	USA	NZL	AUS	GBR	DFS	DEU	ZAF	EST	LVA	LTU	IRL	NLD	CAM
CAN	0	8	240	105	115	107	218	14	75	3	10	22	3	7	0
NOR	7	0	92	64	89	97	158	21	0	40	22	28	49	58	0
USA	226	93	0	151	166	148	243	32	64	34	28	44	25	55	32
NZL	106	63	150	0	185	110	230	27	39	27	22	32	11	34	13
AUS	115	78	168	185	0	116	234	49	38	55	41	50	15	52	15
GBR	104	101	139	106	113	0	148	16	43	19	17	31	19	50	0
DFS	226	133	240	227	207	141	0	75	53	166	136	114	15	67	0
DEU	13	20	30	26	48	16	66	0	1	37	39	27	5	22	0
ZAF	77	0	58	34	39	37	50	1	0	0	2	5	2	2	0
EST	2	39	32	25	49	17	153	36	0	0	55	28	0	32	0
LVA	10	20	25	18	37	16	94	32	2	47	0	48	3	19	0
LTU	21	25	39	30	47	29	101	27	5	27	43	0	6	21	0
IRL	3	48	25	11	14	18	12	5	2	0	3	6	0	10	0
NLD	7	57	54	33	50	49	64	21	2	31	18	20	10	0	0
CAM	0	0	32	13	15	0	0	0	0	0	0	0	0	0	0

RDC pro

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	NOR	USA	NZL	AUS	GBR	DFS	DEU	ZAF	EST	LVA	LTU	IRL	NLD	CAM
CAN	0	8	240	105	115	107	218	14	75	3	10	22	3	7	0
NOR	7	0	92	64	89	97	158	21	0	40	22	28	49	58	0
USA	226	93	0	151	166	149	243	32	64	34	28	44	25	55	32
NZL	106	63	150	0	185	110	230	27	39	27	22	32	11	34	13
AUS	115	78	168	185	0	116	234	49	38	55	41	50	15	52	15
GBR	104	101	140	106	113	0	148	16	43	19	17	31	19	50	0
DFS	226	133	240	227	207	141	0	75	53	166	136	114	15	67	0
DEU	13	20	30	26	48	16	66	0	1	37	39	27	5	22	0
ZAF	77	0	58	34	39	37	50	1	0	0	2	5	2	2	0
EST	2	39	32	25	49	17	153	36	0	0	55	28	0	32	0
LVA	10	20	25	18	37	16	94	32	2	47	0	48	3	19	0
LTU	21	25	39	30	47	29	101	27	5	27	43	0	6	21	0
IRL	3	48	25	11	14	18	12	5	2	0	3	6	0	10	0
NLD	7	57	54	33	50	49	64	21	2	31	18	20	10	0	0
CAM	0	0	32	13	15	0	0	0	0	0	0	0	0	0	0

SIM mil

common bulls below diagonal
common three quarter sib group above diagonal

	CHE	DEA	FRM	SVN	FRA	NLD	IRL	GBR	USA
CHE	0	433	274	1	15	97	57	57	34
DEA	401	0	352	300	283	474	76	67	49
FRM	326	386	0	4	2	143	72	74	102
SVN	1	284	4	0	52	92	5	0	2
FRA	12	240	1	49	0	91	6	0	3
NLD	98	496	165	85	86	0	59	54	34
IRL	54	73	77	5	6	53	0	41	18
GBR	65	78	95	0	0	55	35	0	20
USA	33	53	116	2	3	35	17	28	0

SIM fat

common bulls below diagonal
common three quarter sib group above diagonal

	CHE	DEA	FRM	SVN	FRA	NLD	IRL	GBR	USA
CHE	0	433	274	1	15	97	57	57	34
DEA	401	0	352	300	283	474	76	67	49
FRM	326	386	0	4	2	143	72	74	102
SVN	1	284	4	0	52	92	5	0	2
FRA	12	240	1	49	0	91	6	0	3
NLD	98	496	165	85	86	0	59	54	34
IRL	54	73	77	5	6	53	0	41	18
GBR	65	78	95	0	0	55	35	0	20
USA	33	53	116	2	3	35	17	28	0

CHE	0	432	274	1	15	97	57	57	34
DEA	401	0	352	300	283	474	76	67	49
FRM	326	386	0	4	2	143	72	74	101
SVN	1	284	4	0	52	92	5	0	2
FRA	12	240	1	49	0	91	6	0	3
NLD	98	496	165	85	86	0	59	54	34
IRL	54	73	77	5	6	53	0	41	18
GBR	65	78	95	0	0	55	35	0	20
USA	33	53	115	2	3	35	17	28	0

SIM pro

common bulls below diagonal

common three quarter sib group above diagonal

	CHE	DEA	FRM	SVN	FRA	NLD	IRL	GBR	USA
CHE	0	432	274	1	15	97	57	57	34
DEA	401	0	352	300	283	474	76	67	49
FRM	326	386	0	4	2	143	72	74	101
SVN	1	284	4	0	52	92	5	0	2
FRA	12	240	1	49	0	91	6	0	3
NLD	98	496	165	85	86	0	59	54	34
IRL	54	73	77	5	6	53	0	41	18
GBR	65	78	95	0	0	55	35	0	20
USA	33	53	115	2	3	35	17	28	0