

Introduction

The latest routine international evaluation for udder traits took place as scheduled at the Interbull Centre. Data from thirty-three (33) countries were included in this evaluation.

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

Countries sending real MAS data (other countries participate to the MAS evaluation using SCS data as predictor):

HOL : DFS, NLD, FRA, CAN, ITA, CHE, USA, DEU, GBR, AUS
RDC : DFS, NLD, CAN, GBR, AUS
BSW : NLD, FRA, CHE, GBR, USA
JER : DFS, NLD, CAN, GBR, AUS, USA
SIM : NLD, CHE, GBR
GUE : No evaluation for MAS yet

Changes in national procedures

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

EST (ALL) Decrease in information due to the pedigree correction and updated herd information
NOR (RDC) Decrease in information due to the rolling definition of hys.
DEA (BSW,SIM) Cow base group has been shifted by 4 month (rolling base), decrease in information due to herd changes regarding the movement of cows herds in the valleys back to alpine pasturing.
JPN (HOL) Decrease in information due to the poedigree changes.
AUS (ALL) Decrease in information due to pedigree updates and status changes of some bulls which then leads to no longer qualifying
CHE (ALL) Decrease in information due to the manual edits/ data correction in data base, change of hys assignment
SVN (All) Decrease in information due to the changes in database regarding pedigree completeness and pheontype improvement.
BEL (HOL) Decrease in information due to the pedigree correction
NZL(ALL) Decrease in information due to the continious parentage verification and some phenotypic records updates.
ESP (HOL) Base change.
GBR(ALL) Decrease in information due to the data updates and pedigree correction.

INTERBULL CHANGES COMPARED TO THE PREVIOUS ROUTINE RUN

Post-processing Windows:

According to the decision taken by ITC in Orlando (2015) to review the post-processing windows every 5 years, during the 2020 the relative working group has been re-activated and new windows have been identified.

As before, the upper bounds have been set to 0.99 as these were judged to have very little effect on evaluations while the lower values have been reduced to the 10th percentile. This reduction would provide post-processed correlations to be closer to the real estimated ones. Over the past five years, in fact, the previous adopted lower value (25th percentile) had been found too high causing estimated and post-processed correlations to differ significantly from each other. The new lower values have been applied to all breeds and traits.

The weight assigned to the magnitude of the changes tested by each country has also been revised. The new weight will allow post-processed correlations to take more in consideration the value of the new estimated ones even when no changes are applied by the countries. The new weights are as follows:

No changes :: 2

Small changes:: 1
Big changes :: 0

More information can be read on https://interbull.org/ib/rg_procedure

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
Harris and Johnson. 1998. Interbull Bulletin 17:31-36

NEXT ROUTINE INTERNATIONAL EVALUATION

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

NEXT TEST INTERNATIONAL EVALUATION

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

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.

^aLTable 1. National evaluation data considered in the Interbull evaluation for udder health (August Routine Evaluation 2023).
Number of records for milk somatic cells by breed

Country	BSW	GUE	HOL	JER	RDC	SIM
AUS		148	8825	1753	821	
BEL			2306			
CAN	274	109	13894	881	877	
CHE	3209		3377	100		3633
CZE			4803			
DEA	6045					24858
DEU		24223			302	
DFS		14481		2347	8162	
ESP		4616				
EST		1380			485	
FRA	494		18543			481
FRM						4786
GBR	151	312	7576	773	596	109
HUN			3164			190
IRL			3064			
ISR			1718			
ITA	2175		9673	66		1814
JPN			7016			
KOR			1689			
LTU			898		362	
LVA			1373			674
NLD	232		17108	267	105	
NOR					4336	
NZL	75	57	8887	5091	1447	
POL			12671			
PRT			2965			
SVK			1186			
SVN	334		680			672
URY			2097			
USA	1187	744	42111	5243	766	107
ZAF			1205	616	125	

HRV		971			1056	
CAM				49		
No. Records	14176	1370	222500	17137	19107	38225
Pub. Proofs	11308	1059	159641	13883	17955	34338

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

BSW	SCS	CAN	FRA	NLD	USA	CHE	DEA	NZL	ITA	GBR	SVN
CAN	6.55										
FRA	0.91	1.02									
NLD	0.89	0.92	3.65								
USA	0.89	0.90	0.85	0.21							
CHE	0.90	0.93	0.94	0.81	10.54						
DEA	0.88	0.96	0.92	0.85	0.97	11.93					
NZL	0.71	0.77	0.79	0.67	0.74	0.67	0.37				
ITA	0.88	0.89	0.89	0.83	0.96	0.91	0.68	15.51			
GBR	0.93	0.96	0.95	0.91	0.93	0.95	0.81	0.89	11.54		
SVN	0.80	0.80	0.79	0.79	0.80	0.78	0.68	0.82	0.82	10.88	

BSW	mas	CAN	FRA	NLD	USA	CHE	DEA	NZL	ITA	GBR	SVN
CAN		6.45									
FRA	0.81		1.03								
NLD	0.79	0.73		4.09							
USA	0.81	0.83	0.76		2.73						
CHE	0.88	0.83	0.85	0.76		11.36					
DEA	0.90	0.70	0.87	0.71	0.90		11.93				
NZL	0.69	0.64	0.66	0.64	0.70	0.74		0.37			
ITA	0.85	0.73	0.80	0.68	0.88	0.92	0.70		15.51		
GBR	0.84	0.84	0.83	0.79	0.84	0.74	0.64	0.76		2.18	
SVN	0.79	0.72	0.73	0.72	0.71	0.83	0.76	0.84	0.76		10.89

GUE	SCS	CAN	GBR	USA	AUS	NZL
CAN		5.95				
GBR		0.93	13.56			
USA		0.93	0.90	0.25		
AUS		0.81	0.87	0.77	0.24	
NZL		0.76	0.81	0.70	0.89	0.62

HOL	SCS	CAN	CHE	DEU	DFS	EST	FRA	GBR	NLD	USA	ISR	ITA
CAN		5.70										
CHE	0.90	10.81										
DEU	0.94	0.95	12.88									
DFS	0.93	0.93	0.97	11.75								
EST	0.89	0.89	0.94	0.92	18.88							
FRA	0.94	0.93	0.96	0.96	0.90	1.17						
GBR	0.94	0.94	0.96	0.94	0.90	0.95	12.85					
NLD	0.91	0.94	0.96	0.94	0.91	0.94	0.96	4.23				
USA	0.94	0.84	0.89	0.87	0.90	0.90	0.91	0.86	0.20			
ISR	0.86	0.83	0.85	0.82	0.85	0.83	0.81	0.80	0.87	0.24		
ITA	0.90	0.89	0.95	0.93	0.93	0.93	0.90	0.89	0.89	0.83	5.87	
AUS	0.80	0.86	0.82	0.82	0.75	0.83	0.87	0.84	0.75	0.67	0.78	
HUN	0.88	0.89	0.93	0.91	0.91	0.90	0.89	0.88	0.91	0.87	0.94	
BEL	0.92	0.92	0.97	0.96	0.95	0.96	0.93	0.94	0.89	0.83	0.95	
JPN	0.85	0.78	0.82	0.85	0.81	0.89	0.84	0.80	0.86	0.75	0.80	

RDC SCS

	CAN	DFS	GBR	NOR	USA	DEU	AUS	EST	ZAF	NZL	LTU	LVA	NLD	CAM
CAN	5.99													
DFS	0.94	12.93												
GBR	0.94	0.91	11.65											
NOR	0.86	0.90	0.80	13.60										
USA	0.92	0.86	0.88	0.79	0.23									
DEU	0.94	0.96	0.95	0.89	0.89	14.16								
AUS	0.81	0.84	0.87	0.82	0.72	0.84	0.26							
EST	0.89	0.89	0.89	0.84	0.85	0.93	0.81	18.94						
ZAF	0.83	0.85	0.85	0.88	0.86	0.91	0.75	0.87	25.31					
NZL	0.76	0.78	0.81	0.77	0.71	0.80	0.89	0.79	0.78	0.44				
LTU	0.82	0.88	0.83	0.90	0.79	0.89	0.80	0.88	0.86	0.75	0.37			
LVA	0.86	0.87	0.90	0.84	0.83	0.92	0.82	0.93	0.87	0.79	0.89	436.12		
NLD	0.91	0.95	0.95	0.88	0.86	0.96	0.84	0.89	0.88	0.81	0.85	0.88	3.91	
CAM	0.89	0.89	0.89	0.88	0.82	0.89	0.86	0.88	0.88	0.85	0.87	0.87	0.89	6.20

RDC mas

	CAN	DFS	GBR	NOR	USA	AUS	EST	ZAF	NZL	LTU	LVA	NLD	CAM
CAN	7.91												
DFS	0.89	13.50											
GBR	0.87	0.84	2.17										
NOR	0.81	0.71	0.72	13.60									
USA	0.79	0.73	0.78	0.79	0.23								
AUS	0.66	0.65	0.66	0.77	0.68	0.12							
EST	0.81	0.73	0.79	0.83	0.80	0.73	18.94						
ZAF	0.83	0.81	0.82	0.87	0.79	0.72	0.84	25.38					
NZL	0.64	0.63	0.66	0.75	0.70	0.73	0.83	0.77	0.43				
LTU	0.75	0.72	0.77	0.85	0.77	0.73	0.90	0.85	0.80	0.37			
LVA	0.78	0.72	0.80	0.86	0.75	0.71	0.94	0.86	0.83	0.91	435.89		
NLD	0.83	0.78	0.84	0.87	0.83	0.71	0.86	0.85	0.71	0.82	0.85	4.65	
CAM	0.83	0.84	0.84	0.88	0.81	0.85	0.88	0.88	0.88	0.87	0.88	0.85	6.20

SIM SCS

	FRM	FRA	ITA	NLD	CHE	DEA	HUN	SVN	GBR	HRV	USA
FRM	1.09										
FRA	0.88	1.01									
ITA	0.88	0.87	12.47								
NLD	0.92	0.93	0.84	3.96							
CHE	0.93	0.93	0.87	0.93	10.43						
DEA	0.92	0.93	0.85	0.91	0.89	12.24					
HUN	0.88	0.90	0.92	0.88	0.89	0.89	16.37				
SVN	0.84	0.82	0.82	0.81	0.84	0.80	0.82	9.22			
GBR	0.91	0.95	0.87	0.95	0.90	0.93	0.89	0.83	10.85		
HRV	0.86	0.79	0.79	0.79	0.80	0.78	0.83	0.78	0.80	9.67	
USA	0.84	0.90	0.87	0.87	0.85	0.81	0.91	0.78	0.90	0.79	0.20

STM mas

^aLAPPENDIX II. Number of common bulls

BSW

common bulls below diagonal

common three quarter sib group above diagonal

CAN FRA NLD USA CHE DEA NZL ITA GBR SVN

CAN	0	97	58	187	150	159	32	144	68	32
FRA	89	0	93	135	196	258	29	229	64	52
NLD	53	80	0	91	112	167	30	144	41	46
USA	183	99	82	0	332	343	37	241	95	40
CHE	128	155	102	310	0	646	36	510	78	76
DEA	143	214	156	310	540	0	50	730	80	103
NZL	32	23	23	33	29	45	0	42	23	11
ITA	128	195	117	170	454	630	35	0	82	95
GBR	69	57	36	94	62	57	21	62	0	20
SVN	29	51	45	32	72	94	10	91	16	0

BSW

common bulls below diagonal

common three quarter sib group above diagonal

CAN FRA NLD USA CHE DEA NZL ITA GBR

CAN	0	86	55	58	74	157	32	142	32	32
FRA	79	0	69	26	79	220	23	198	31	51
NLD	48	60	0	20	54	149	30	132	21	45
USA	59	25	18	0	30	51	15	44	19	12
CHE	68	64	51	26	0	255	17	219	20	60
DEA	143	176	138	45	222	0	50	729	39	102
NZL	32	20	23	14	15	45	0	42	11	11
ITA	127	166	106	35	192	630	35	0	43	95
GBR	31	28	18	18	17	29	9	34	0	14
SVN	29	49	44	11	57	94	10	91	12	0

GUE

common bulls below diagonal

common three quarter sib group above diagonal

CAN GBR USA AUS NZL

CAN	0	35	78	54	14
GBR	30	0	92	43	13
USA	70	94	0	72	29
AUS	52	36	70	0	26
NZL	11	11	28	26	0

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common bulls below diagonal

common sibis below diagonal
common three quarter sib group above diagonal

CAN CHE DEU PES EST FRA GBR NLD USA

	CAN	CHE	DEU	DPS	EST	FRA	GBR	NED	USA	ISR	FRA	HES	HUN	IRL	ESP	ZAF	NZL	IRE	CZE	SVK	COL	LTC	EVA	PRY	ROR	SVN	HRV	SRV	
CAN	0	944	2659	1761	325	1703	1839	1838	4024	166	2005	1627	1122	928	1519	1477	505	843	579	1307	468	1795	300	566	1260	802	231	348	884
CHE	871	0	1218	795	194	784	749	996	1074	71	785	688	455	663	514	618	257	454	405	561	249	775	145	272	566	299	144	221	343

HOL

common bulls below diagonal
common three quarter sib group above diagonal

CAN CHE DEU DFS EST FRA GBR NLD US

CAN	0	276	755	911	207	973	1015	394	1354	104	1302	935	735	595	910	958	251	469	343	803	258	1188	217	368	800	563	182	243	522
CHE	244	0	264	258	73	266	256	166	261	28	276	248	129	224	186	218	64	159	130	169	70	281	59	86	181	120	74	68	106
DEU	591	232	0	1021	253	893	806	590	748	92	1015	674	560	589	557	710	199	412	324	742	230	1365	256	422	589	312	270	423	344
DFS	937	236	899	0	350	1441	1439	813	1126	164	1345	1313	919	882	1029	1108	488	873	690	1326	362	1786	324	465	1032	518	254	443	618
EST	135	38	185	239	0	271	287	191	262	59	299	245	221	222	234	240	110	156	133	312	117	410	96	181	225	138	97	145	154
FRA	780	236	660	915	152	0	1300	580	963	123	1341	1143	910	940	1061	1185	414	716	591	1229	352	1798	242	404	968	514	208	327	528
GBR	1040	238	655	1153	182	945	0	607	1237	171	1374	1395	888	883	1039	1121	465	907	850	1125	345	1516	286	417	1002	513	212	353	656
NLD	375	156	530	824	134	476	591	0	413	93	564	529	401	572	385	475	207	489	359	711	177	938	164	249	506	212	153	296	284
USA	1560	228	622	1156	202	774	1342	372	0	184	1541	1090	881	606	1086	958	351	601	441	1024	290	1594	245	502	964	686	201	245	756
ISR	70	13	63	118	36	76	120	72	181	0	146	131	121	94	129	124	64	130	97	154	54	183	52	77	124	75	50	74	99
ITA	1105	241	775	1147	187	891	1157	513	1573	100	0	1060	958	753	1091	1251	346	592	471	1203	343	1783	291	470	1022	601	247	358	610
AUS	1011	217	532	954	134	853	1239	452	1214	85	882	0	783	800	1000	989	464	1276	697	948	303	1215	243	394	911	492	176	314	692
HUN	710	100	437	766	138	667	793	337	939	84	861	606	0	579	778	847	383	542	413	1011	309	1071	235	373	811	492	163	283	503
BEL	625	217	594	831	144	949	896	592	583	59	775	728	516	0	592	745	330	555	486	725	286	917	172	295	737	333	173	295	367
JPN	634	138	343	593	94	489	610	283	855	61	619	594	465	411	0	1004	425	614	431	948	309	1144	215	387	803	604	169	252	583
ESP	671	170	500	867	122	971	927	450	790	76	924	721	699	750	520	0	442	603	480	981	313	1294	227	399	963	541	203	318	538
ZAF	236	51	153	373	56	326	429	183	393	42	288	413	319	287	299	399	0	363	283	402	169	409	99	162	431	253	72	148	305
NZL	425	137	328	619	83	490	760	444	572	105	488	1279	422	459	348	463	296	0	712	692	256	757	180	264	637	330	128	240	557
IRL	340	130	286	525	72	481	828	339	425	70	404	573	339	460	271	438	234	584	0	506	189	608	141	200	458	222	100	181	346
CZE	626	119	566	906	206	799	845	686	967	121	934	650	942	597	478	737	287	518	365	0	498	1582	278	440	909	524	231	405	577
SVK	184	27	136	203	55	214	219	99	204	23	228	160	229	186	129	177	96	160	96	452	0	440	92	156	324	204	73	146	227
POL	1131	230	1378	1511	312	1338	1367	933	1804	144	1588	980	997	871	663	991	314	599	481	1378	331	0	390	624	1203	642	301	532	699
LTU	136	21	207	203	45	110	167	102	179	25	160	122	150	89	77	100	40	88	66	192	46	313	0	189	226	140	69	154	161
LVA	227	32	331	281	103	202	249	154	421	49	290	195	272	174	175	220	94	147	107	292	77	501	127	0	423	257	117	264	268
PRT	836	157	516	954	159	888	970	506	1072	81	1026	782	827	770	531	954	395	527	393	782	226	1259	151	332	0	524	176	340	579
KOR	556	95	226	394	69	341	394	153	756	40	521	370	406	255	401	398	196	245	155	391	129	556	68	157	463	0	113	155	393
SVN	140	53	260	203	59	160	155	122	162	35	216	120	122	134	96	150	51	86	74	168	36	270	31	68	140	72	0	124	100
HRV	157	43	414	359	107	241	268	267	197	53	277	205	218	245	126	252	108	149	126	318	79	502	112	212	295	80	100	0	190
URY	512	79	261	475	94	384	605	226	842	63	516	608	452	313	398	476	289	499	287	468	153	643	103	162	540	341	57	123	0

JER

common bulls below diagonal

common three quarter sib group above diagonal

CAN DES GBR NLD USA AUS ZAF NZL CHE ITA

CAN	0	140	182	50	502	285	161	201	42	33
DFS	135	0	196	175	233	178	163	179	61	36
GBR	186	191	0	104	262	245	175	243	74	41
NLD	45	179	97	0	116	86	81	98	42	27
USA	531	216	288	122	0	532	300	407	74	42
AUS	293	149	250	77	580	0	243	469	60	41
ZAF	157	146	178	77	316	233	0	210	57	38
NZL	210	156	248	93	480	522	219	0	56	34
CHE	36	60	72	36	75	50	50	48	0	28
ITA	28	35	41	22	41	35	33	32	28	0

JER

common bulls below diagonal

common three quarter sib group above diagonal

CAN	DFS	GBR	NLD	USA	AUS	ZAF	NZL	CHE	ITA
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CAN	0	53	89	22	98	138	75	97	26	22
DFS	48	0	127	146	73	143	141	151	59	33
GBR	87	121	0	77	94	181	138	176	66	38
NLD	15	142	73	0	44	81	78	89	39	27
USA	89	62	95	43	0	177	127	135	41	26
AUS	126	109	185	74	187	0	238	464	57	40
ZAF	68	120	140	75	138	232	0	205	54	38
NZL	90	125	179	84	135	515	216	0	52	34
CHE	24	56	64	34	35	50	49	47	0	27
ITA	18	31	36	22	25	34	33	32	28	0

RDC

common bulls below diagonal

common three quarter sib group above diagonal

CAN	DFS	GBR	NOR	USA	DEU	AUS	EST	ZAF	NZL	LTU	LVA	NLD	CAM
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CAN	0	192	91	7	221	14	106	3	70	94	22	10	7	0
DFS	198	0	126	138	218	66	212	135	51	190	103	132	64	0
GBR	92	121	0	70	131	16	98	14	40	96	26	16	45	0
NOR	6	113	74	0	85	16	77	28	0	51	19	19	52	0
USA	208	216	126	86	0	25	150	26	59	136	37	25	49	31
DEU	13	57	16	15	23	0	44	32	1	22	28	36	18	0
AUS	107	186	93	66	153	43	0	42	34	166	43	40	43	13
EST	2	124	12	28	25	32	39	0	0	19	22	53	22	0
ZAF	72	48	35	0	53	1	34	0	0	35	5	2	3	0
NZL	92	187	91	51	137	22	167	18	30	0	22	19	27	13
LTU	21	89	24	18	33	27	40	22	5	22	0	44	15	0
LVA	10	91	16	17	22	30	36	46	2	16	40	0	17	0
NLD	7	62	44	51	48	17	41	21	3	27	14	16	0	0
CAM	0	0	0	0	31	0	13	0	0	13	0	0	0	0

RDC

common bulls below diagonal

common three quarter sib group above diagonal

CAN	DFS	GBR	NOR	USA	AUS	EST	ZAF	NZL	LTU	LVA	NLD	CAM
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CAN	0	88	33	3	83	34	0	35	37	18	7	3	0
DFS	87	0	87	140	209	227	135	46	188	102	126	63	0
GBR	31	82	0	60	92	61	7	27	65	20	14	34	0
NOR	3	114	63	0	85	77	28	0	51	19	19	45	0
USA	82	207	90	86	0	139	26	54	133	37	25	47	31
AUS	34	204	59	66	143	0	42	31	157	40	38	41	12
EST	0	124	7	28	25	39	0	0	19	22	49	21	0
ZAF	36	46	26	0	52	33	0	0	33	5	2	2	0
NZL	37	183	63	51	137	159	18	30	0	22	18	24	13
LTU	17	88	18	18	33	38	22	5	22	0	44	14	0
LVA	7	84	14	17	22	35	42	2	15	40	0	14	0
NLD	3	61	34	44	47	39	20	2	24	13	13	0	0
CAM	0	0	0	0	31	12	0	0	13	0	0	0	0

SIM

common bulls below diagonal

common three quarter sib group above diagonal

FRM FRA ITA NLD CHE DEA HUN SVN GBR HRV USA

FRM	0	2	186	132	240	275	2	11	66	2	86
FRA	1	0	142	80	14	259	4	50	0	102	3
ITA	211	125	0	258	101	1009	18	151	45	334	34
NLD	157	76	252	0	94	396	8	85	48	167	31
CHE	292	11	103	98	0	367	2	53	2	34	
DEA	314	216	920	417	333	0	37	261	48	726	39
HUN	0	3	15	8	1	24	0	10	0	19	0
SVN	10	48	143	79	2	246	9	0	0	131	1
GBR	83	0	49	48	60	51	0	0	0	0	20
HRV	1	92	317	163	2	760	17	120	0	0	4
USA	101	3	41	32	33	42	0	1	27	4	0

SIM

common bulls below diagonal

common three quarter sib group above diagonal

FRM FRA ITA NLD CHE DEA HUN SVN GBR HRV USA

FRM	0	2	157	104	5	227	2	11	25	2	37
FRA	1	0	84	31	2	161	3	25	0	58	1
ITA	182	71	0	247	9	1008	18	151	18	334	34
NLD	127	30	241	0	8	362	8	78	18	158	31
CHE	5	2	9	8	0	97	0	0	1	0	5
DEA	275	124	920	381	90	0	37	261	20	726	39
HUN	0	2	15	8	0	24	0	10	0	19	0
SVN	10	22	143	73	0	246	9	0	0	131	1
GBR	34	0	23	20	1	25	0	0	0	0	17
HRV	1	51	317	155	0	760	17	120	0	0	4
USA	52	1	41	32	5	42	0	1	23	4	0