

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, IRL
RDC : DFS, NLD, CAN, GBR, AUS
BSW : NLD, FRA, CHE, GBR
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:

AUS (ALL) This is a new trait (analysed since April) and historical data from various sources are still being collected, this shows in considerable increases in number of bulls, daughters and records for some birth years. For the same reason some bulls have added large numbers of effective daughters which sometimes led to changes in EBVs greater than 3.5 SD. New EDC calculation. Base change, updated the status of bulls to better reflect their status as AI bull. As a result a good number no longer qualify and were not submitted.

DEA (ALL) Base change, for SIM drops in edc. Inclusion of SVK data into the joined evaluation DEU+AUT+CZE

SVN (ALL) Small decrease in information due to changes in data base related to the pedigree completeness as well as phenotypic data improvement.

DEU (HOL, RDC) MAS: larger numbers of bulls have lost daughters and herds for HOL. This is explained by data changes and (mainly) effects of adjusted inclusion criteria for cow records in GE. RDC base change, data submitted now according to same settings as per HOL.

DFS (ALL) Updated pedigree program used for genetic evaluation. The effect is minor. For mastitis, an error in the definition of herd was corrected. No loss in data, but number of herds have changed.

ISR (HOL) Base change

ITA (SIM) Changed the way to calculate the reliability and edc.

JPN (HOL) Base change, now the cows born in 2015 are the base. Some changes in information due to pedigree verification

BEL (HOL) Base change now set to cows born in 2015

HUN (HOL, SIM) Base change

USA (HOL, JER) MAS: Inclusion of a sire by herd interaction and new variance estimates for random environmental effects.

GBR (ALL) Changes in information due to changes from data recording agents

NZL (ALL) Changes in information due to continuous pedigree verification

PRT (HOL) New variance components estimation, Base change

EST (HOL, RDC) For the next two years all breeding values are standardised within breed to a base with mean of 100 and a genetic standard deviation of 12 points for cows born 2012-2016.

ZAF (ALL) Refining genetic groups. Changing from PEST software to MIX99 for estimation of breeding values and reliabilities. Stricter editing especially for Holstein for somatic cell score data. Base Year Change.

INTERBULL CHANGES COMPARED TO THE PREVIOUS ROUTINE RUN

Subsetting:

As decided by the ITC in Orlando, new subsetting was introduced in the september test run. Sub-setting is necessary for operational purposes and restrictions of time scales. To minimize the effect of subsetting, larger subsets with 10-12 countries and with 4 link providing countries have been applied.

Window:

According to the decision taken by ITC in Orlando, the following changes have been introduced in regards to the windows used for post processing:

The upper bounds have been set to 0.99 as these were judged to have very little effect on evaluations. The lower values have been set to about the 25% percentile value. The largest changes are for the lower values for conformation traits, with the lowest window being 40% for OFL otherwise it is about 50% for all other confirmation traits. It is anticipated that these low values may not have large impact on evaluations since there were very few countries combinations whose estimated correlations fell between the old limit of 0.30 and these new limits.

The window so far applied for MAS evaluation have been found too high compared to the within-country genetic correlation between mastitis and SCS available from the literature. It has been an ITC recommendation to adjust the windows for MAS in the 2001t test run to make them more in line with the values available from the literature. The recommendation has been approved by the Steering committee. Also, according to the decision taken by ITC in Orlando (2015) to review all windows every five (5) years, an overall review of the windows for all traits will take place during the first half of 2020. Implementation of the reviewed windows is aimed for January 2021 test run.

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.

^LTable 1. National evaluation data considered in the Interbull evaluation for udder health (December Routine Evaluation 2020).
Number of records for milk somatic cells by breed

Country	BSW	GUE	HOL	JER	RDC	SIM
AUS		140	8400	1682	760	
BEL			2120			
CAN	248	101	13025	800	840	
CHE	3045		3558	91		3367
CZE			4423			
DEA	5767					23366
DEU			22789		276	
DFS			13642	2244	7968	
ESP			4143			
EST			1215		459	
FRA	410		17505			474
FRM						4492
GBR	134	293	7078	719	535	83
HUN			3039			181
IRL			2702			
ISR			1549			
ITA	1998		9906			1654
JPN			6423			

DEA	0.92	0.93	0.88	0.90	0.89	12.27					
HUN	0.93	0.91	0.93	0.89	0.90	0.93	17.02				
SVN	0.90	0.89	0.88	0.89	0.90	0.88	0.90	8.95			
GBR	0.91	0.96	0.90	0.95	0.91	0.93	0.89	0.88	11.40		
HRV	0.93	0.89	0.88	0.88	0.89	0.88	0.89	0.89	0.88	9.87	
USA	0.89	0.90	0.89	0.88	0.89	0.89	0.91	0.89	0.90	0.88	0.20

SIM mas

	FRM	FRA	ITA	NLD	CHE	DEA	HUN	SVN	GBR	HRV	USA
FRM	1.08										
FRA	0.90	1.00									
ITA	0.92	0.84	12.96								
NLD	0.87	0.87	0.81	4.21							
CHE	0.88	0.92	0.89	0.90	11.17						
DEA	0.91	0.92	0.86	0.87	0.84	12.27					
HUN	0.90	0.85	0.89	0.88	0.88	0.92	17.02				
SVN	0.89	0.86	0.85	0.82	0.86	0.85	0.86	8.95			
GBR	0.84	0.88	0.83	0.85	0.91	0.86	0.84	0.84	2.71		
HRV	0.89	0.85	0.84	0.80	0.84	0.85	0.86	0.86	0.83	9.87	
USA	0.85	0.88	0.83	0.86	0.85	0.85	0.78	0.78	0.82	0.78	0.19

^LAPPENDIX 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	84	52	174	136	146	25	127	61	36
FRA	73	0	85	120	162	216	23	191	52	62
NLD	49	70	0	81	98	154	28	131	40	50
USA	164	81	72	0	320	320	30	227	83	44
CHE	112	118	91	297	0	593	27	459	68	87
DEA	127	159	148	287	491	0	40	647	68	115
NZL	23	18	21	27	21	35	0	32	18	13
ITA	109	150	111	160	400	545	25	0	70	107
GBR	54	41	29	73	50	45	15	47	0	23
SVN	32	60	51	36	82	107	12	106	17	0

BSW

common bulls below diagonal

common three quarter sib group above diagonal

	CAN	FRA	NLD	USA	CHE	DEA	NZL	ITA	GBR	SVN
CAN	0	78	49	174	42	146	25	127	29	36
FRA	68	0	70	106	46	203	20	180	25	62
NLD	44	59	0	75	26	138	28	119	20	45
USA	164	72	65	0	41	319	30	225	37	44
CHE	36	35	25	29	0	128	8	108	9	40
DEA	127	150	130	287	122	0	40	642	32	114
NZL	23	16	21	27	8	35	0	32	11	13
ITA	109	144	99	160	100	544	25	0	34	107
GBR	26	20	14	33	5	22	8	24	0	13
SVN	32	59	46	36	39	107	12	106	10	0

GUE

common bulls below diagonal

common three quarter sib group above diagonal

	CAN	GBR	USA	AUS	NZL
CAN	0	30	71	47	14
GBR	25	0	87	36	13
USA	62	89	0	65	29

AUS	46	31	61	0	26
NZL	11	11	29	26	0

GUE

HOL

common bulls below diagonal

common three quarter sib group above diagonal

	CAN	CHE	DEU	DFS	EST	FRA	GBR	NLD	USA	ISR	ITA	AUS	HUN	BEL	JPN	ESP	ZAF	NZL	IRL	CZE	SVK	POL	LTU	LVA	PRT	KOR	SVN	HRV	URY
CAN	0	910	2353	1498	268	1510	1627	1596	3497	138	1798	1468	1068	830	1386	1336	503	764	507	1157	428	1481	299	207	1032	689	222	294	787
CHE	775	0	1157	743	169	699	709	927	1032	63	757	641	451	615	496	585	269	415	366	550	237	710	179	138	508	268	148	200	323
DEU	1752	1029	0	2629	417	2375	1978	3285	3454	167	2601	1658	1261	1225	1426	1545	546	964	763	1851	679	2559	606	299	1206	620	330	597	779
DFS	1291	664	1915	0	297	1664	1545	2174	2144	154	1651	1326	934	882	1001	1065	501	850	672	1293	410	1681	365	206	938	484	266	390	654
EST	162	94	301	182	0	264	252	372	353	50	286	219	209	199	214	212	106	138	118	268	116	335	115	87	195	116	98	122	139
FRA	1010	606	1233	884	127	0	1527	2001	2515	126	1711	1294	959	951	1224	1178	471	804	648	1264	424	1715	295	186	931	514	209	284	604
GBR	1850	648	1486	1171	144	938	0	1746	2190	148	1561	1401	882	865	1048	1080	505	907	838	1068	374	1361	302	180	932	489	222	320	677
NLD	1534	902	3044	1924	269	1241	1516	0	2566	164	1798	1511	1000	1304	1095	1164	512	1059	792	1556	543	1948	397	227	1054	478	282	426	679
USA	3902	920	2424	1634	236	1328	1937	2262	0	195	2683	1968	1368	984	1998	1589	630	1091	706	1688	540	2175	405	260	1298	851	258	366	1133
ISR	98	39	130	113	32	66	100	124	182	0	149	116	118	83	110	111	64	111	89	130	48	151	57	28	103	61	48	65	96
ITA	1469	682	1755	1262	164	922	1201	1502	1898	102	0	1239	1068	835	1212	1321	475	742	582	1303	395	1710	336	223	1004	598	256	377	692
AUS	1486	555	1230	967	112	860	1207	1324	1967	74	917	0	761	767	928	919	478	1217	651	881	310	1079	261	167	786	442	185	286	685
HUN	1007	364	1002	754	128	644	770	858	1335	80	923	575	0	558	750	802	392	515	398	954	314	1015	231	140	713	455	173	253	532
BEL	828	622	1264	831	127	933	857	1509	876	55	822	673	486	0	570	696	336	525	458	677	298	842	212	144	662	300	187	262	362
JPN	745	328	649	565	79	446	556	601	946	50	589	533	433	373	0	942	425	580	406	871	320	1037	221	149	716	556	179	218	601
ESP	872	471	1009	806	102	855	862	1050	1039	66	976	656	644	684	458	0	446	555	454	891	318	1113	238	167	836	483	204	278	536
ZAF	460	218	424	383	55	329	439	433	612	42	373	414	316	284	297	394	0	363	290	402	180	412	116	99	430	261	99	149	322
NZL	771	345	737	602	73	480	780	971	1039	90	552	1225	399	429	319	424	295	0	651	635	256	675	184	114	567	312	136	213	543
IRL	449	343	604	519	59	459	787	692	590	65	460	528	322	431	248	410	236	527	0	470	191	551	149	94	415	198	113	161	340
CZE	866	401	1437	880	172	793	773	1418	1333	98	936	591	877	548	415	653	282	468	339	0	499	1393	319	191	795	477	227	348	572
SVK	304	122	503	215	53	227	215	380	358	21	240	155	224	186	120	162	96	154	92	427	0	455	135	96	319	202	86	140	238
POL	1271	579	2296	1374	243	1111	1139	1809	2072	115	1330	813	909	776	561	791	307	512	423	1161	316	0	443	251	1018	575	275	444	655
LTU	160	80	561	212	61	106	154	247	272	29	183	116	141	109	76	104	47	87	70	218	69	348	0	101	236	147	81	164	174
LVA	131	78	204	126	62	86	103	149	208	20	151	79	100	91	66	95	58	55	52	126	47	186	73	0	189	99	43	115	121
PRT	1078	449	1103	831	138	784	862	1059	1357	75	941	632	711	670	447	807	386	465	350	666	222	1021	151	142	0	459	168	309	551
KOR	660	188	414	349	59	299	356	339	960	37	481	320	370	222	340	337	195	228	132	343	123	479	64	59	385	0	103	137	385
SVN	163	106	317	214	58	144	163	244	197	36	215	130	130	151	100	152	71	95	84	168	47	250	44	26	133	63	0	106	112
HRV	171	127	611	300	89	168	227	384	275	45	285	176	189	214	102	212	99	125	107	253	68	392	113	90	247	58	82	0	180
URY	761	243	555	465	84	358	554	548	1403	53	505	535	434	292	352	432	283	444	257	415	147	543	99	80	492	303	66	107	0

HOL

common bulls below diagonal

common three quarter sib group above diagonal

	CAN	CHE	DEU	DFS	EST	FRA	GBR	NLD	USA	ISR	ITA	AUS	HUN	BEL	JPN	ESP	ZAF	NZL	IRL	CZE	SVK	POL	LTU	LVA	PRT	KOR	SVN	HRV	URY
CAN	0	128	638	747	161	811	866	867	1063	84	1126	817	677	524	811	851	248	404	300	699	234	994	188	107	621	472	160	193	445
CHE	116	0	122	117	32	115	124	150	121	11	128	124	65	112	96	104	41	89	77	87	35	129	32	9	79	62	44	32	55
DEU	475	113	0	806	195	692	671	977	578	75	853	581	502	503	479	612	190	339	284	620	194	1073	249	120	447	258	216	324	281
DFS	735	107	677	0	271	1248	1278	1846	867	140	1282	1197	860	789	942	1002	486	784	638	1188	341	1506	325	187	871	439	242	347	544
EST	102	13	139	164	0	221	230	358	199	49	255	212	203	191	208	207	103	133	116	263	102	320	106	83	187	111	97	119	127
FRA	599	105	447	678	111	0	1145	1529	796	106	1309	1010	828	799	956	1012	383	634	540	1090	315	1472	239	153	802	425	186	241	447
GBR	868	113	540	983	138	744	0	1594	992	147	1313	1259	838	803	952	1016	466	826	785	1022	330	1287	263	154	863	449	212	293	576
NLD	891	137	944	1511	264	974	1397	0	1018	161	1494	1463	977	1259	1081	1140	504	1041	790	1534	495	1872	355	216	1025	455	272	398	600
USA	1224	105	465	853	143	605	1082	1045	0	133	1212	905	802	523	921	801	345	503	381	843	246	1154	217	153	716	563	176	186	618
ISR	56	2	52	100	32	59	98	123	127	0	135	115	115	83	108	111	62	110	89	130	47	149	51	28	103	59	48	61	88
ITA	906	115	617	998	155	721	1061	1265	1196	88	0	1048	974	730	1092	1182	401	610	488	1165	335	1531	284	190	899	546	234	307	569
AUS	876	116	447	832	112	698	1103	1278	976	74	821	0	745	744	920	914	463	1189	646	872	287	1061	233	158	764	418	183	269	613
HUN	640	50	382	687	128	566	747	844	847	78	865	570	0	545	743	794	381	509	394	949	296	994	214	136	697	435	171	240	473
BEL	543	107	505	729	126	781	824	1464	504	55	742	667	485	0	557	682	332	514	455	666	276	817	193	136	648	291	186	253	338
JPN	548	76	280	507	79	395	543	595	720	50	561	530	433	373	0	942	421	574	406	871	298	1024	202	144	695	530	176	202	526
ESP	550	86	419	739	102	753	842	1023	632	66	847	650	643	684	458	0	441	554	453	891	294	1102	221	161	826	469	201	265	483
ZAF	232	34	148	366	55	286	424	428	383	42	330	408	315	284	297	394	0	361	288	398	170	403	107	95	421	247	98	138	300
NZL	372	81	271	544	72	404	688	957	472	90	489	1191	399	427	319	424	294	0	650	633	246	671	169	109	558	300	135	202	498
IRL	298	73	25																										

LTU	116	13	209	197	60	96	151	237	156	29	160	116	140	108	76	104	47	86	70	218	66	336	0	95	212	127	77	146	151
LVA	72	4	104	114	62	76	96	146	127	20	125	79	99	91	66	95	58	54	52	126	47	179	73	0	181	95	43	107	108
PRT	632	72	396	763	137	698	831	1046	777	75	872	620	705	668	447	807	384	464	350	666	218	1002	147	141	0	439	166	286	501
KOR	452	51	182	321	59	264	343	332	614	37	461	309	366	222	340	337	194	224	132	343	121	469	60	59	382	0	102	121	340
SVN	120	32	204	191	58	134	162	236	140	36	197	129	130	150	100	152	71	95	84	168	47	248	44	26	133	63	0	102	105
HRV	119	16	308	268	89	156	225	370	144	45	232	174	189	212	102	212	99	125	107	253	68	387	112	88	245	57	81	0	164
URY	439	39	206	410	84	294	523	533	685	52	478	530	424	291	352	432	280	441	257	415	146	529	98	76	482	294	66	106	0

JER

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	DFS	GBR	NLD	USA	AUS	ZAF	NZL	CHE
CAN	0	109	158	40	444	262	150	179	38
DFS	102	0	171	128	196	156	152	148	59
GBR	158	163	0	88	233	217	164	215	68
NLD	36	130	80	0	88	74	73	75	40
USA	468	176	251	95	0	498	282	363	66
AUS	268	126	220	66	541	0	227	436	53
ZAF	145	134	163	69	297	217	0	196	56
NZL	184	125	215	68	432	481	203	0	50
CHE	31	57	64	34	66	43	48	41	0

JER

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	DFS	GBR	NLD	USA	AUS	ZAF	NZL	CHE
CAN	0	41	69	17	77	115	66	81	23
DFS	36	0	103	100	49	123	126	124	56
GBR	65	95	0	59	75	148	122	146	62
NLD	11	94	54	0	29	69	70	68	37
USA	70	40	74	25	0	144	105	102	34
AUS	104	88	150	62	152	0	219	430	50
ZAF	60	104	122	66	116	214	0	192	53
NZL	73	97	146	60	102	473	201	0	47
CHE	20	52	57	32	27	42	47	40	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
CAN	0	173	78	7	203	13	101	2	71	89	17	7	7	0
DFS	176	0	100	129	194	50	191	111	52	167	103	91	56	0
GBR	77	92	0	52	106	14	82	8	39	81	26	11	35	0
NOR	6	103	55	0	75	14	69	22	0	40	25	17	44	0
USA	189	190	99	76	0	20	131	19	60	120	34	14	43	24
DEU	12	41	14	13	20	0	36	22	1	17	29	28	15	0
AUS	101	163	78	59	132	36	0	31	35	143	43	28	33	12
EST	2	100	7	22	18	22	29	0	0	10	25	36	17	0
ZAF	73	49	35	0	54	1	34	0	0	35	5	1	4	0
NZL	87	165	75	40	121	17	142	9	31	0	27	13	20	12
LTU	16	98	24	22	29	28	42	25	5	25	0	36	15	0
LVA	7	59	11	15	10	22	25	28	1	10	32	0	9	0
NLD	7	54	34	43	42	14	31	16	4	20	14	8	0	0
CAM	0	0	0	0	24	0	12	0	0	12	0	0	0	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
CAN	0	74	29	3	73	8	32	0	35	33	13	4	3	0
DFS	73	0	73	131	182	50	206	111	47	165	102	92	53	0

GBR	28	68	0	47	76	13	53	5	27	57	21	9	25	0
NOR	3	103	50	0	75	14	69	22	0	40	25	17	37	0
USA	73	177	74	76	0	20	121	19	55	118	34	14	39	24
DEU	8	41	13	13	20	0	36	22	1	17	29	28	13	0
AUS	31	182	51	59	124	36	0	31	32	137	41	27	30	10
EST	0	100	5	22	18	22	29	0	0	10	25	36	17	0
ZAF	36	47	26	0	53	1	34	0	0	33	5	1	3	0
NZL	33	161	55	40	121	17	137	9	31	0	27	13	18	12
LTU	12	97	19	22	29	28	41	25	5	25	0	36	14	0
LVA	4	59	9	15	10	22	25	28	1	10	32	0	8	0
NLD	3	51	25	37	39	13	28	16	3	18	13	7	0	0
CAM	0	0	0	0	24	0	10	0	0	12	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	3	172	124	205	257	2	17	65	2	56	
FRA	1	0	151	73	12	268	6	57	0	93	2	
ITA	205	136	0	225	94	909	16	127	44	240	30	
NLD	148	70	220	0	90	332	7	65	48	109	24	
CHE	257	9	97	94	0	335	2	5	51	2	29	
DEA	283	227	817	342	291	0	34	215	48	548	29	
HUN	0	5	13	7	1	22	0	10	0	17	0	
SVN	17	54	122	62	5	199	9	0	0	81	1	
GBR	82	0	48	48	58	51	0	0	0	0	19	
HRV	1	83	225	105	2	572	15	67	0	0	3	
USA	71	2	35	26	28	30	0	1	26	3	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	159	105	4	228	2	17	25	2	36	
FRA	1	0	85	31	1	161	3	34	0	58	1	
ITA	192	75	0	213	4	907	16	127	18	240	29	
NLD	127	30	207	0	4	307	7	61	18	103	23	
CHE	4	1	4	4	0	47	0	0	1	0	2	
DEA	270	124	817	315	42	0	34	215	20	548	28	
HUN	0	2	13	7	0	22	0	10	0	17	0	
SVN	17	29	122	58	0	199	9	0	0	81	1	
GBR	34	0	23	20	1	25	0	0	0	0	16	
HRV	1	51	225	99	0	572	15	67	0	0	3	
USA	51	1	34	25	2	30	0	1	22	3	0	