

## 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  
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 udder traits are as follows:

ISR (HOL)	Slight reductions for a few bulls in number of daughters due to edits and paternity corrections
SVN (ALL)	Some changes in information due to changes in data base related to the pedigree completeness and phenotypic data improvement
FRA (ALL)	Some drops in information due to corrections made in pedigree
AUS (ALL)	Decrease in information as a result of data clean up such as pedigree changes, causing also changes in type of proofs. Change of status of bull which leads to a good number of bulls no longer being qualified. Decreases in EDC due to rounding.
AUS (RDC)	Completely different analysis for the red breeds which are now analysed separately from the other breeds holsteins and Jersey
DEA (BSW,SIM)	Base change. Some drops in reliability due to pedigree changes. For SIM few bulls show slight decrease in number of herds/EDC with same number of daughters. This could be expected with herd changes regarding to the movement of cows from alpine pasturing back to herds in the valleys.
POL (HOL)	Test data submission as a result of a new software application. Computational technologies we used so far seems not to be able to deal with still growing data amount in near future. Software upgrade based on new libraries and compilers implementation, improved data workflow without changing mathematical model itself.
JPN (HOL)	Drops in information due to parentage checks
BEL (HOL)	Some decrease in information due to pedigree correction
CHE (HOL)	In-depth corrections and renewal of the database table containing bull information by one of our breeding associations lead to changes in status of bulls and type of proof as well as a fewer number of EBV delivered. Slight changes in number of daughters, number of herds and EDC are due to manual edits in the database.
CHE (SIM)	In-depth corrections and renewal of the database table containing bull information by one of our breeding associations lead to changes in status of bulls and type of proof as well as a fewer number of EBV delivered. Slight changes in number of daughters, number of herds and EDC are due to manual edits in the database.
ITA (SIM)	Small decrease in information due to pedigree correction
GBR (HOL)	Loss of information due to data changes that occurred in one of the major data providers providing highest proportion of the HOL data, it affects more SCS/mas as such traits are recorded by farmers voluntarily and suffered more from data changes
NZL (ALL)	Daughter counts $\hat{a}_{200\ 223}$ affects all traits. New Zealand has continuous DNA parentage testing so daughters will always change Herd Count $\hat{a}_{200\ 223}$ affects all traits. Affected by continuous DNA parentage testing. EDCs $\hat{a}_{200\ 223}$ affects all traits. Affected by continuous DNA parentage testing and a bug was found in the EDC calculation so a fix was applied
NZL (ALL)	same model as what used before but running on Bolt software. Wrong heritability was used in the calculation of EDC which has now been corrected.

IRL (HOL) SCC: we have developed a whole new test-day model for SCS - the current model is a 305day lactation model - heritability is slightly higher 0.14 compare to the current 0.11. The TDM for SCC is a 3 parity trait model - the published breeding value is a composite of the 3 parity PTAs (as opposed to 1 heifer parity equivalent PTA).

#### 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](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.

^LTable 1. National evaluation data considered in the Interbull evaluation for udder health (December Routine Evaluation 2021).  
Number of records for milk somatic cells by breed

Country	BSW	GUE	HOL	JER	RDC	SIM
AUS		146	8597	1719	801	
BEL			2193			
CAN	269	103	13379	832	855	
CHE	3102		3232	96		3461
CZE			4549			
DEA	5882					23911
DEU			23354		284	

DFS			13955	2274	8048	
ESP			4324			
EST			1277		467	
FRA	423		17731			490
FRM						4603
GBR	139	294	7274	743	552	85
HUN			3163			190
IRL			3003			
ISR			1606			
ITA	2059		9755	76		1684
JPN			6644			
KOR			1523			
LTU			1269			435
LVA			527			564
NLD	214		16586	215		95
NOR						4260
NZL	69	57	8593	4942	1406	
POL			11784			
PRT			2491			
SVK			1149			
SVN	408		664			714
URY			1974			
USA	1140	718	40779	5020	732	84
ZAF			1211	602	125	
HRV			893			1002
CAM					44	
=====						
No. Records	13705	1318	213479	16519	18668	36692
Pub. Proofs	11032	1021	156591	13479	17678	32954
-----						

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

-----										
BSW	scs									
	CAN	FRA	NLD	USA	CHE	DEA	NZL	ITA	GBR	SVN
CAN	6.43									
FRA	0.92	1.04								
NLD	0.89	0.92	3.97							
USA	0.90	0.90	0.86	0.21						
CHE	0.91	0.94	0.93	0.83	10.51					
DEA	0.91	0.96	0.92	0.86	0.97	11.95				
NZL	0.71	0.78	0.81	0.67	0.77	0.72	0.36			
ITA	0.89	0.89	0.88	0.85	0.95	0.91	0.69	15.99		
GBR	0.92	0.96	0.95	0.91	0.93	0.94	0.82	0.89	11.85	
SVN	0.84	0.83	0.84	0.83	0.83	0.83	0.68	0.83	0.85	10.35

-----										
BSW	mas									
	CAN	FRA	NLD	USA	CHE	DEA	NZL	ITA	GBR	SVN
CAN	6.43									
FRA	0.84	1.04								
NLD	0.82	0.78	3.95							
USA	0.84	0.79	0.83	0.21						
CHE	0.89	0.84	0.88	0.80	11.42					
DEA	0.92	0.75	0.88	0.84	0.91	11.95				
NZL	0.69	0.64	0.72	0.68	0.70	0.74	0.36			
ITA	0.86	0.77	0.82	0.78	0.88	0.92	0.69	15.99		
GBR	0.85	0.86	0.83	0.80	0.88	0.78	0.64	0.79	2.25	
SVN	0.81	0.75	0.76	0.79	0.75	0.80	0.75	0.82	0.79	10.35

-----					
GUE	scs				
	CAN	GBR	USA	AUS	NZL
CAN	6.19				





CAM 0.86 0.86 0.86 0.90 0.83 0.85 0.89 0.89 0.88 0.90 0.90 0.87 6.35

-----

SIM scs

-----

	FRM	FRA	ITA	NLD	CHE	DEA	HUN	SVN	GBR	HRV	USA
FRM	1.10										
FRA	0.90	1.01									
ITA	0.88	0.88	12.66								
NLD	0.91	0.93	0.86	4.30							
CHE	0.93	0.93	0.88	0.93	10.40						
DEA	0.91	0.93	0.86	0.91	0.89	12.27					
HUN	0.90	0.90	0.92	0.88	0.89	0.91	16.37				
SVN	0.89	0.84	0.84	0.84	0.86	0.83	0.86	9.09			
GBR	0.91	0.95	0.88	0.95	0.90	0.93	0.89	0.85	11.60		
HRV	0.87	0.81	0.82	0.81	0.82	0.81	0.85	0.82	0.82	9.84	
USA	0.85	0.90	0.88	0.87	0.86	0.84	0.91	0.83	0.90	0.82	0.20

-----

SIM mas

-----

	FRM	FRA	ITA	NLD	CHE	DEA	HUN	SVN	GBR	HRV	USA
FRM	1.08										
FRA	0.88	1.00									
ITA	0.91	0.82	12.65								
NLD	0.86	0.86	0.79	4.14							
CHE	0.85	0.89	0.88	0.86	9.63						
DEA	0.92	0.92	0.85	0.87	0.77	12.27					
HUN	0.88	0.83	0.89	0.87	0.86	0.90	16.37				
SVN	0.88	0.82	0.82	0.79	0.82	0.82	0.84	9.09			
GBR	0.79	0.88	0.78	0.82	0.89	0.81	0.83	0.80	2.73		
HRV	0.85	0.79	0.80	0.73	0.79	0.80	0.83	0.81	0.76	9.84	
USA	0.81	0.86	0.74	0.84	0.81	0.81	0.75	0.72	0.80	0.74	0.20

^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	88	56	184	143	153	31	136	68	37
FRA	78	0	87	121	166	220	27	195	56	62
NLD	52	70	0	85	102	158	30	136	42	53
USA	182	81	76	0	322	331	35	233	95	47
CHE	122	122	95	299	0	606	33	475	77	90
DEA	138	163	151	296	503	0	46	675	80	119
NZL	31	21	23	32	26	41	0	37	23	14
ITA	120	154	113	163	415	573	30	0	80	110
GBR	69	48	36	94	61	56	21	60	0	24
SVN	34	60	54	38	86	111	13	108	21	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	81	52	184	68	153	31	136	31	37
FRA	73	0	71	106	69	206	23	184	28	62
NLD	46	60	0	76	44	142	29	125	21	49
USA	182	73	66	0	88	330	35	233	41	47
CHE	62	52	44	65	0	217	16	186	18	56
DEA	138	153	134	296	185	0	46	675	38	119
NZL	31	19	22	32	14	41	0	37	10	14
ITA	120	148	103	163	156	573	30	0	41	110
GBR	30	24	18	41	15	27	8	32	0	14

SVN 34 60 50 38 53 111 13 108 12 0

GUE

common bulls below diagonal
common three quarter sib group above diagonal

Table with 5 columns: CAN, GBR, USA, AUS, NZL. Rows include CAN, GBR, USA, AUS, NZL with numerical values.

GUE

HOL

common bulls below diagonal
common three quarter sib group above diagonal

Large table with 28 columns (CAN to URY) and 28 rows (CAN to URY) containing numerical data.

HOL

common bulls below diagonal
common three quarter sib group above diagonal

Large table with 28 columns (CAN to URY) and 28 rows (CAN to URY) containing numerical data.



AUS	943	183	477	882	117	725	1162	413	1092	77	851	0	773	763	958	942	467	1230	670	906	292	1121	249	158	777	447	192	298	650
HUN	692	96	414	738	135	585	781	314	918	82	900	596	0	563	766	832	384	528	406	987	304	1053	230	136	708	457	179	274	498
BEL	580	183	539	767	131	802	848	532	537	55	769	690	507	0	568	708	333	529	472	687	279	861	202	135	658	310	193	282	356
JPN	588	123	304	544	86	406	574	250	767	52	593	559	456	389	0	967	426	595	419	897	303	1069	223	144	707	559	183	236	549
ESP	613	147	452	790	112	783	877	402	697	69	877	679	686	718	487	0	445	571	465	929	302	1162	235	161	844	495	209	299	515
ZAF	239	52	155	375	56	292	432	187	396	42	326	417	322	290	301	402	0	363	288	402	170	411	109	96	427	252	99	146	307
NZL	395	122	296	574	76	416	723	384	519	97	493	1235	416	438	335	439	298	0	681	658	252	698	182	111	567	315	143	226	522
IRL	321	116	271	497	65	429	794	311	396	65	412	544	335	449	261	422	239	559	0	486	185	573	145	91	420	208	116	172	331
CZE	571	107	494	831	183	655	793	627	849	104	870	616	917	568	439	687	289	493	353	0	484	1449	313	183	797	483	238	376	544
SVK	177	24	120	191	53	178	216	94	181	22	214	155	226	182	123	169	96	158	94	439	0	420	115	88	305	193	89	138	220
POL	1004	194	1170	1309	255	1052	1202	837	1479	123	1359	881	976	811	608	852	317	548	452	1239	312	0	439	236	1000	577	285	481	633
LTU	129	23	227	210	62	106	169	125	174	29	173	125	150	117	84	110	48	94	70	228	69	356	0	95	222	140	81	161	163
LVA	72	7	104	114	62	76	96	50	127	20	121	79	99	91	66	95	58	55	51	126	47	179	73	0	181	95	43	107	110
PRT	656	119	413	782	139	711	847	426	816	77	872	635	720	682	456	825	393	473	360	680	217	1021	154	142	0	458	170	311	518
KOR	504	79	198	345	64	277	364	129	667	38	488	335	381	234	364	358	197	234	143	363	123	495	64	59	396	0	110	144	361
SVN	129	41	226	202	60	141	168	126	153	35	206	136	136	155	106	160	73	102	89	182	50	261	45	26	136	67	0	121	111
HRV	143	37	371	314	98	183	249	247	179	50	261	193	209	233	118	239	107	141	117	294	74	451	124	89	267	70	96	0	179
URY	476	68	225	446	87	307	559	194	764	55	503	567	443	305	372	454	289	458	275	441	149	575	106	78	494	314	66	118	0

JER

common bulls below diagonal										
common three quarter sib group above diagonal										
	CAN	DFS	GBR	NLD	USA	AUS	ZAF	NZL	CHE	ITA
CAN	0	119	167	43	465	273	154	189	40	37
DFS	111	0	177	145	208	165	156	159	59	41
GBR	171	172	0	93	244	228	169	225	72	48
NLD	39	147	86	0	98	78	78	84	40	29
USA	492	188	268	104	0	516	289	386	70	48
AUS	280	134	233	69	562	0	237	446	57	46
ZAF	150	138	170	74	305	227	0	201	56	44
NZL	196	136	233	79	459	494	211	0	54	39
CHE	34	58	69	34	71	48	49	46	0	33
ITA	32	41	48	24	47	40	39	36	33	0

JER

common bulls below diagonal										
common three quarter sib group above diagonal										
	CAN	DFS	GBR	NLD	USA	AUS	ZAF	NZL	CHE	ITA
CAN	0	44	79	19	87	124	69	87	24	24
DFS	39	0	115	113	59	131	131	133	57	38
GBR	75	107	0	68	83	165	130	159	64	43
NLD	12	107	64	0	34	74	74	77	37	29
USA	79	47	82	31	0	162	115	120	36	26
AUS	113	96	168	67	172	0	230	440	53	45
ZAF	63	109	131	71	126	226	0	197	53	44
NZL	79	106	163	72	122	487	208	0	50	39
CHE	22	54	61	32	30	47	48	45	0	32
ITA	20	36	42	24	25	39	39	36	33	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	180	83	7	212	14	103	3	70	92	17	7	7	0
DFS	185	0	108	134	206	55	201	118	51	176	111	91	59	0
GBR	85	104	0	56	115	14	87	9	39	87	28	11	39	0
NOR	6	108	59	0	79	14	73	24	0	46	26	17	45	0
USA	198	201	111	79	0	23	140	23	59	129	35	14	46	25
DEU	13	46	14	13	22	0	39	24	1	18	30	28	15	0
AUS	104	174	83	62	142	38	0	35	34	151	46	28	37	12
EST	2	107	8	24	22	24	32	0	0	12	26	36	19	0
ZAF	72	48	35	0	53	1	34	0	0	35	5	1	3	0
NZL	90	173	83	46	130	18	151	11	30	0	29	13	23	12

LTU	16	98	25	22	29	28	42	25	5	25	0	38	16	0
LVA	7	59	11	15	10	22	25	28	1	10	32	0	9	0
NLD	7	57	38	44	45	14	34	18	3	23	14	8	0	0
CAM	0	0	0	0	25	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	AUS	EST	ZAF	NZL	LTU	LVA	NLD	CAM
CAN	0	75	29	3	73	33	0	35	34	13	4	3	0
DFS	74	0	74	136	197	216	118	46	173	110	92	56	0
GBR	28	70	0	51	79	54	5	27	60	22	9	30	0
NOR	3	109	54	0	79	73	24	0	46	26	17	40	0
USA	73	194	78	80	0	129	23	54	126	35	14	44	25
AUS	33	192	52	62	132	0	35	31	143	43	27	33	10
EST	0	107	5	24	22	32	0	0	12	26	36	18	0
ZAF	36	46	26	0	52	33	0	0	33	5	1	2	0
NZL	34	168	59	46	131	144	11	30	0	29	13	21	12
LTU	12	97	19	22	29	40	25	5	25	0	38	15	0
LVA	4	59	9	15	10	25	28	1	10	32	0	8	0
NLD	3	54	30	39	44	31	17	2	21	13	7	0	0
CAM	0	0	0	0	25	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	174	128	221	270	2	17	67	2	64
FRA	1	0	153	78	12	276	6	60	0	110	3
ITA	200	136	0	232	95	931	18	139	46	306	33
NLD	153	75	229	0	91	353	8	67	49	150	28
CHE	273	9	98	95	0	350	2	5	53	2	32
DEA	315	234	843	373	316	0	37	246	49	678	34
HUN	0	5	15	8	1	24	0	12	0	19	0
SVN	17	57	132	64	5	227	11	0	0	121	1
GBR	84	0	50	49	60	52	0	0	0	0	19
HRV	1	100	293	148	2	710	17	110	0	0	4
USA	79	3	39	30	31	40	0	1	26	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	228	2	17	25	2	36
FRA	1	0	85	31	1	161	3	34	0	59	1
ITA	183	74	0	223	7	930	18	139	18	306	33
NLD	127	30	219	0	6	325	8	64	18	144	25
CHE	5	1	7	6	0	79	0	0	1	0	4
DEA	276	124	843	344	71	0	37	246	20	678	34
HUN	0	2	15	8	0	24	0	12	0	19	0
SVN	17	29	132	61	0	227	11	0	0	121	1
GBR	34	0	23	20	1	25	0	0	0	0	16
HRV	1	51	293	143	0	710	17	110	0	0	4
USA	51	1	39	27	4	40	0	1	22	4	0