INTERBULL breeding values calculated April 2020

This newsletter is primarily written for VikingGenetics staff and breeding advisors in Denmark, Sweden and Finland, but can also be of interest for dairy farmers.

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International breeding values for the traits and breeds shown in table 1 have been published 7th April 2020

Current evaluation	
Daugher proven bulls: **Yield** Conformation Somatic cell count and udder health Longevity Calving – maternal and direct Female fertility Milking speed and **temperament** NTM **for Nordic and foreign bulls** Changes since last **run**	**Young genomic tested bulls - HOL:** **Yield** Conformation Somatic cell count and udder health Longevity Calving – maternal and direct Female fertility Milking speed and temperament Changes since last **run**

Table 1. Traits and breeds for which international breeding values are published.

Trait:	**International breeding values for the breeds:**
Yield	Red breeds, Holstein and Jersey
Conformation	Red breeds, Holstein and Jersey
Udder health	Red breeds, Holstein and Jersey
Longevity	Red breeds, Holstein and Jersey
Calving – maternal and direct	Red breeds and Holstein
Female fertility	Red breeds, Holstein and Jersey
Milking speed	Red breeds, Holstein and Jersey
Temperament	Red breeds and Holstein

You can find Interbull breeding values for all bulls with international breeding values on www.nordicebv.info

On the page you can search within breed or country. You can also search with the herdbook number or the name of the bull. Click on the herdbook number of the bull and view a graphical representation of the bulls breeding values.

You can sort the bulls by different breeding values by clicking on the top line of the table.

Bulls from Denmark, Finland and Sweden are in the following grouped under DNK/FIN/SWE

Daughter proven bulls

In the tables below, only sires that have breeding values based on daughter information is shown

Yield

In tables 2-4 is a comparison of the genetic level of yield for bulls from different countries. The analysis includes bulls born in 2013 or later, that have more than 60 daughters in the genetic evaluation.

Table 2. Genetic level for yield traits, Red breeds. Bulls born in 2013 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Australia	20	94,2	94,6	91,7	92,7	11,2
Canada	43	90,1	90,8	85,6	87,4	8,1
Germany	12	102,5	108,3	102,8	105,9	9,2
DNK/FIN/SWE	359	101,3	102,9	103,4	103,6	8,0
Estonia	18	98,9	99,4	98,2	98,8	8,8
UK	8	80,9	79,8	72,4	74,4	7,1
Norway	292	95,0	94,4	95,4	95,0	9,4
New Zealand	30	88,8	92,8	88,0	90,4	9,9
USA	9	77,8	77,3	71,3	72,9	12,1

Table 3. Genetic level for yield traits, Holstein. Bulls born in 2013 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Australia	64	95,8	100,1	95,7	98,1	6,7
Belgium	27	103,3	104,2	103,0	103,6	9,7
Canada	473	108,3	108,7	105,6	106,7	8,2
Switzerland	79	95,4	100,8	95,6	98,5	8,8
Czech Republic	27	104,3	105,1	101,2	102,6	7,9
Germany	731	109,6	107,1	107,2	106,5	9,0
DNK/FIN/SWE	369	103,7	104,6	105,7	105,6	9,2
Spain	75	107,6	103,1	101,1	100,7	6,6
Estonia	32	100,9	96,2	94,5	93,8	6,1
France	313	104,4	102,8	103,2	102,7	7,9
UK	136	102,1	106,5	101,5	104,1	12,0
Hungary	5	110,4	107,0	103,2	103,8	6,7
Ireland	165	76,7	92,6	84,2	90,8	9,1
Israel	103	98,3	105,0	98,1	101,9	7,7
Italy	317	104,7	104,7	102,9	103,5	8,4
Japan	45	109,7	106,0	105,4	104,7	8,3
Luxembourg	7	108,4	107,4	104,6	105,3	10,7
Netherlands	673	104,3	104,6	103,9	104,2	10,0
New Zealand	719	79,9	94,2	89,9	94,8	7,0
Poland	74	102,4	100,9	99,3	99,5	7,3
Slovenia	22	92,5	90,3	88,3	88,3	7,8
USA	2558	109,3	110,1	106,4	107,8	9,3

Table 4. Genetic level for yield traits, Jersey. Bulls born in 2013 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Australia	27	107,6	89,3	103,0	92,7	5,7
Canada	12	105,8	93,2	99,9	93,8	16,4
DNK/FIN/SWE	81	100,9	103,6	103,6	104,5	8,5
New Zealand	335	98,2	90,8	98,3	93,5	8,1
USA	421	118,1	101,1	112,4	103,4	10,4

International comparison for yield among most important populations shows that:

- Red breeds: DNK/FIN/SWE have higher genetic level than Norway and Canada
- Holstein: DNK/FIN/SWE, Canada, Germany, USA, and Netherlands have similar genetic level
- Jersey: Denmark has same genetic level than USA, but higher genetic level than New Zealand

Conformation

The international genetic evaluation is done for 16 linear traits for Holstein, Red breeds and Jersey. In addition, frame condition score and locomotion are included in this trait group.

Breeding values for frame

EBV for frame is calculated from the 6 linear traits that are part of the international genetic evaluation. The composite NAV breeding value for frame also includes topline. There is no international genetic evaluation of topline.

We calculate international breeding value for frame based on a regression of NAV breeding values for the 6 linear international traits on NAV EBV for frame for Danish, Swedish and Finnish bulls born in 2004-05. The estimated regression coefficients are used to calculate international breeding value for frame for foreign bulls. This method is used to ensure the same relative weight between traits in NAV and international composite traits.

Breeding values for feet and legs

EBV for feet and legs is calculated from the 3 linear traits that are part of the international genetic evaluation. The composite NAV breeding values for feet and legs also include hock quality and bone quality. There is no international genetic evaluation for these two traits.

We calculate international breeding value for feet and legs based on a regression of NAV breeding values for the 3 linear international traits on NAV EBV for feet and legs for Danish, Swedish and Finnish bulls born in 2004-05. The estimated regression coefficients are used to calculate international breeding value for feet and legs for foreign bulls.

Breeding values for udder

The international genetic evaluation for udder includes 7 traits. The Nordic genetic evaluation for udder also includes teat thickness and udder balance. There is no international evaluation for these two traits.

We calculate international breeding value for udder based on a regression of NAV breeding values for the 7 linear international traits on NAV EBV for udder for Danish, Swedish and Finnish bulls born in 2004-05. The estimated regression coefficients are used to calculate international breeding value for udder for foreign bulls.

Genetic level of composite conformation traits

In tables 5-7 is a comparison of genetic level of composite conformation traits for bulls from different countries. The calculation includes bulls that have at least 25 daughters in genetic evaluation.

Table 5. Genetic level for conformation traits, Red breeds. Bulls born in 2013 or later.

Country	No. of bulls	Frame		Feet&legs		Udder	
		Average	STD	Average	STD	Average	STD
Canada	41	100,1	6,5	103,1	3,7	107,4	7,5
Germany	19	104,2	7,6	106,8	3,5	103,4	8,3
DNK/FIN/SWE	222	98,6	10,2	100,2	5,0	101,7	8,3
UK	6	107,8	6,6			109,7	7,4
Norway	61	101,1	8,5	98,2	4,6	85,6	6,9

Table 6. Genetic level of conformation traits, Holstein. Bulls born in 2013 or later.

Country	No	Frame		Feet&legs		Udder	
		Average	STD	Average	STD	Average	STD
Australia	26	110,3	9,2	98,2	3,9	100,4	13,2
Belgium	27	113,6	13,6	104,1	5,4	106,2	10,5
Canada	392	117,4	10,2	101,8	5,7	112,5	9,5
Switzerland	115	111,5	9,6	99,7	5,3	108,8	8,6
Czech Republic	32	112,5	7,2	102,0	5,3	104,2	11,7
Germany	718	111,9	9,5	102,6	5,9	107,4	9,6
DNK/FIN/SWE	365	102,7	11,1	101,3	6,3	103,8	8,7
Spain	89	118,6	9,3	100,9	6,4	108,1	7,8
Estonia	28	107,1	6,6	100,3	5,7	92,3	9,3
France	266	116,3	11,4	102,6	5,7	110,4	8,9
UK	103	113,1	10,9	100,8	4,6	107,7	10,9
Hungary	6	114,5	9,8	103,3	6,0	109,0	3,0
Ireland	49	90,5	10,3	96,9	4,9	81,2	12,5
Italy	284	114,7	10,9	101,1	4,8	109,0	9,0
Japan	313	114,1	9,1	100,5	4,8	104,6	9,4
Korea	6	108,3	4,8	99,3	3,2	108,3	3,7
Luxembourg	6	107,8	8,2	103,3	2,7	106,2	9,1
Netherlands	581	110,3	9,8	103,5	6,1	105,3	9,5
New Zealand	687	85,1	9,7				
Poland	81	110,8	9,2	99,3	4,0	96,0	8,3
Slovenia	20	102,6	11,5	99,6	3,6	93,8	6,9
USA	1304	113,2	10,1	100,8	5,3	110,8	8,9

Table 7. Genetic level of conformation traits, Jersey. Bulls born in 2013 or later.

Country	No	Frame		Feet&legs		Udder	
		Average	STD	Average	STD	Average	STD
Australia	8	110,0	6,8	102,3	5,8	92,4	10,6
Canada	18	115,3	7,4	106,1	4,7	102,1	7,2
DNK/FIN/SWE	100	100,8	9,5	100,5	6,7	101,3	8,0
USA	429	113,9	8,7	103,4	6,9	100,3	8,2

International comparison for conformation traits among most important populations show that:

- Red breeds: Canada have generally higher genetic level for udder than DNK/FIN/SWE. Compared to Norway, DNK/FIN/SWE have similar genetic level for feet&legs and higher level for udder

- Holstein: DNK/FIN/SWE has lower genetic level for frame than most other populations. North America, Spain, France, Germany, UK, Netherlands and Italy have the highest genetic level for frame. Populations with grass based dairy farming like Ireland and New Zealand has lower genetic level for frame. For feet&legs there are only small differences between populations. DNK/FIN/SWE has a below average genetic level for udder. North America and France has the highest genetic level for udder.

- Jersey: Denmark has lower genetic level for frame than USA, but same level for udders

Somatic cell count and udder health

Interbull does two international genetic evaluations – one for somatic cell count and one for udder health. In the first one only somatic cell count is included for all countries. NAV sends breeding values for somatic cell count to Interbull, so Nordic bulls get official breeding values for somatic cell count in countries where this trait is official. In the second evaluation breeding values based on mastitis diagnoses are included. NAV's official breeding value for udder health is used. For countries that do not record mastitis diagnoses, somatic cell count is included in this evaluation.

Index for udder health is published in the Nordic countries, when reliability is 40% or higher. In tables 8-10 is a comparison of genetic level of udder health for bulls from different countries.

Table 8. Genetic level for udder health, Red breeds. Bulls born in 2013 or later.

Country	No. of bulls	Average	STD
Australia	11	98,8	8,4
Germany	6	97,6	9,6
DNK/FIN/SWE	220	100,5	8,4
Norway	181	95,4	11,5
New Zealand	66	92,7	7,6
USA	5	87,7	11,2

Table 9. Genetic level for udder health, Holstein. Bulls born in 2013 or later.

Country	No. of bulls	Average	STD
Australia	98	95,3	7,1
Belgium	25	99,2	8,1
Canada	202	97,6	7,8
Switzerland	12	95,9	4,8
Czech Republic	31	97,3	7,1
Germany	441	98,7	7,6
DNK/FIN/SWE	293	102,4	7,9
Spain	98	95,4	8,0
Estonia	27	94,4	9,5
France	284	98,8	6,6
UK	64	98,3	8,2
Hungary	6	99,7	9,7
Ireland	162	94,4	9,0
Israel	105	98,0	9,7
Italy	264	98,3	8,7
Japan	262	94,5	8,2
Korea	18	90,8	4,9
Netherlands	605	99,0	7,6
New Zealand	763	90,7	7,2
Poland	105	95,1	8,2
Slovenia	26	95,3	8,5
USA	1102	99,8	7,9

Table 10. Genetic level for udder health, Jersey. Bulls born in 2013 or later.

Country	No. of bulls	Average	STD
Australia	34	91,3	6,1
DNK/FIN/SWE	74	100,5	6,9
New Zealand	411	94,1	6,9
USA	190	86,5	8,6

International comparison for udder health among most important populations show that:

- Red breeds: DNK/FIN/SWE has higher genetic level than Norway
- Holstein: DNK/FIN/SWE have higher genetic level than other major European populations, USA and Canada
- Jersey: Denmark is substantially better than USA

Longevity

In tables 11-13 is a comparison of genetic level of longevity for bulls from different countries. Bulls are included if they have at least 40 daughters in the genetic evaluation.

Table 11. Genetic level for longevity, Red breeds. Bulls born in 2012 or later.

Country	No. of bulls	Average	STD
Australia	10	90,9	13,6
Canada	47	89,8	10,0
Germany	22	92,7	5,9
DNK/FIN/SWE	264	102,2	8,1
UK	8	80,8	5,9
Norge	277	90,5	7,9
New Zealand	23	86,8	3,8
USA	12	81,2	10,3

Table 12. Genetic level for longevity, Holstein. Bulls born in 2012 or later.

Country	No. of bulls	Average	STD
Australia	72	86,8	5,7
Austria	7	91,7	2,7
Belgium	39	100,1	6,7
Canada	682	99,7	9,1
Switzerland	150	89,5	8,0
Czech Republic	39	103,0	7,7
Germany	1014	101,1	9,2
DNK/FIN/SWE	475	103,4	8,0
Spain	124	96,7	6,5
France	445	94,4	7,7
UK	159	98,3	8,3
Hungary	10	94,5	6,9
Ireland	185	91,3	5,8
Israel	142	92,5	5,2
Italy	349	98,1	6,8
Luxembourg	10	95,8	4,4
Netherlands	1067	99,5	8,6
New Zealand	727	89,6	5,9
Poland	326	91,8	8,2
Slovenia	40	89,3	8,7
USA	3021	104,5	8,7

Table 13. Genetic level for longevity, Jersey. Bulls born in 2012 or later.

Country	No. of bulls	Average	STD
Australia	19	87,7	5,8
Canada	11	90,3	8,9
DNK/FIN/SWE	97	101,0	7,5
UK	7	87,2	6,1
New Zealand	303	91,6	4,9
USA	579	94,7	7,3

International comparison for longevity among most important populations shows that:

- Red breeds: DNK/FIN/SWE has higher level than the other populations
- Holstein: France has the lowest level, while USA and DNK/FIN/SWE have the highest level
- Jersey: Denmark has higher genetic level than other populations

Calving – maternal and direct

For Red breeds Canada, Denmark, Finland, Norway, Sweden and the United States send data to this evaluation. It has not been possible to obtain sufficient high correlations between countries for still birth so the international evaluation only includes calving ease (maternal and direct) for Red breeds.

In the Holstein group there are international breeding values for both still birth (maternal and direct) and calving ease (maternal and direct), but only for first lactation. In the Nordic countries also information from later lactations and from birth weight is included in calving, maternal and calving, direct.

We have calculated international indices for calving, maternal and calving, direct by performing a regression between NAV breeding values for still birth and calving ease and NAV breeding value for calving for Nordic bulls born in 2001-2006. The calculated regression coefficients are used to calculate a calving index for foreign bulls - same method is used for calving, maternal and calving, direct.

In Tables 14 and 15 the average genetic level for Red breed and Holstein bulls is shown for different countries. Only bulls born in 2013 or later are included. Bulls need to have breeding values for yield to be included.

Table 14. Genetic level for calving, maternal and calving, direct, Red breeds. Bulls born in 2013 or later.

Country	Calving, direct			Calving, maternal		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Canada	42	95,3	7,5	20	96,5	6,9
DNK/FIN/SWE	221	100,6	7,6	213	100,7	6,4
Norway	181	99	7,9	181	88,2	7,2

Table 15. Genetic level for calving, maternal and calving, direct, Holstein. Bulls born in 2013 or later.

Country	Calving, direct			Calving, maternal		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	107	95,6	5,7	2	92,0	14,1
Belgium	27	96,7	6,1	26	99,6	7,3
Canada	513	97,7	6,0	434	100,3	7,9
Switzerland	124	95,0	5,9	78	92,7	10,3
Germany	783	98,0	7,0	668	99,2	8,3
DNK/FIN/SWE	373	102,0	6,6	369	102,6	7,8
Spain	67	95,4	4,8	35	99,1	5,0
France	356	97,1	7,3	309	103,2	9,0
UK	122	98,7	5,5	42	100,2	6,9
Ireland	111	100,2	4,4	0		
Israel	40	97,0	6,5	115	95,9	6,6
Italy	328	96,2	6,7	97	99,1	6,2
Luxembourg	7	97,1	8,3	5	100,8	6,5
Netherlands	668	97,6	6,6	537	98,0	8,5
New Zealand	761	99,0	5,1	0		
USA	2778	98,5	5,2	1934	101,7	6,7

International comparison for calving traits among most important populations shows that:

- Red breeds: DNK/FIN/SWE and Norway have similar genetic level for calving, direct. For calving, maternal DNK/FIN/SWE has a higher level than Norway
- Holstein: DNK/FIN/SWE are among the best populations for both calving, direct and calving, maternal.

Female fertility

NAV calculates breeding values for female fertility based on linear regression between NAV breeding values for female fertility and NAV breeding values for the sub-indices in female fertility. Basis for the regressions are Nordic bulls born in 2001-2005 – see more information below. The estimated regression coefficients are used to calculate international breeding value for female fertility for foreign bulls.

In practice 3 regressions are calculated with different explaining variables (Jersey only 2 and 3):

1: Female fertility = Ability to conceive (R^2, HOL = 0,05) (R^2, Red breeds = 0,35)
2: Female fertility = Days open (R^2, HOL = 0,87) (R^2, Red breeds = 0,85) (R^2, Jer = 0,87)
3: Female fertility = Ability to return to recycle after calving + ability to conceive + Days open (R^2, HOL = 0,96) (R^2, Red breeds = 0,94), (R^2, Jer = 0,94).

R^2 (degree of explanation) indicates the proportion of the variance of the index for female fertility, that the traits in the regression can explain. Since the regression is used on foreign bulls, and the genetic correlations between international and NAV traits are not 1, the observed degree of explanation will be lower.

For each foreign bull we use the regression with the greatest explanatory power given the international sub-indices that are available. The degree of explanation therefore depends largely of the traits being available from the different countries.

Table 16. Genetic level for female fertility, Red breeds. Bulls born in 2013 or later.

Country	No. of bulls	Average	STD
Australia	5	86,0	9,3
Canada	30	95,5	5,4
Germany	5	86,4	7,1
DNK/FIN/SWE	207	100,0	8,5
Norway	172	113,1	8,4
New Zealand	22	98,7	6,8

Table 17. Genetic level for female fertility, Holstein. Bulls born in 2013 or later.

Country	No. of bulls	Average	STD
Australia	48	90,8	8,8
Belgium	25	95,3	7,6
Canada	458	95,0	9,5
Switzerland	74	94,5	3,9
Czech Republic	24	96,5	2,1
Germany	650	93,7	8,6
DNK/FIN/SWE	376	101,8	10,7
Spain	20	90,0	6,7
France	231	95,0	9,0
UK	128	97,4	7,8
Ireland	127	108,1	3,6
Israel	100	97,7	2,5
Italy	249	94,3	7,9
Japan	45	89,9	6,8
Netherlands	600	95,5	8,9
New Zealand	719	100,1	4,7
Poland	40	87,8	8,6
USA	2426	97,5	9,1

Table 18. Genetic level for female fertility, Jersey. Bulls born in 2013 or later.

Country	No. of bulls	Average	STD
Australia	23	89,8	8,2
Canada	12	87,3	9,2
DNK/FIN/SWE	99	102,4	10,1
New Zealand	335	98,1	6,1
USA	409	85,3	11,9

International comparison for female fertility among most important populations shows that:

- Red breeds: DNK/FIN/SWE has a lower level than Norway
- Holstein: DNK/FIN/SWE have a high genetic level. However, Ireland have the highest level
- Jersey: Genetic level is higher in Denmark than the other major countries

Milking speed and temperament

In Tables 19-21, the genetic level for bulls from different countries, born in 2013 or later are shown for Holstein, Red breeds and Jersey.

Table 19. Genetic level for milking speed and temperament, Red breeds. Bulls born in 2013 or later.

Country	Milking speed			Temperament		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Canada	38	91,7	11,3	37	92,6	10,0
Germany	18	99,5	7,4	18	98,7	5,2
DNK/FIN/SWE	235	100,7	8,2	204	100,4	10,5
Norway	137	95,7	4,1	146	96,3	5,6
New Zealand	20	102,3	6,5	20	100,5	6,5

Table 20. Genetic level for milking speed and temperament, Holstein. Bulls born in 2013 or later.

Country	Milking speed			Temperament		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	50	102,9	4,6	50	102,6	4,9
Austria	5	94,6	7,3			
Belgium	18	99,2	8,6	18	101,7	9,9
Canada	323	99,6	9,1	316	104,0	8,4
Switzerland	119	94,2	7,4	120	100,4	7,1
Germany	606	99,2	9,1	463	103,1	10,6
DNK/FIN/SWE	359	100,7	9,2	244	102,7	14,8
France	241	98,4	8,5	241	104,1	9,0
UK	109	101,1	14,8	103	104,0	10,2
Italy	251	100,0	9,2	250	105,3	6,7
Luxembourg	5	102,0	10,8			
Netherlands	506	96,9	10,0	477	103,0	9,1
New Zealand	713	103,7	4,0	713	99,1	2,8
Slovenia	27	97,5	6,5			
USA	543	100,8	10,5	526	106,1	9,2

Table 21. Genetic level for milking speed, Jersey. Bulls born in 2013 or later.

Country	No. of bulls	Average	STD
Australien	29	100,2	7,4
Canada	22	93,2	9,5
DNK/FIN/SWE	139	100,1	9,7
New Zealand	461	99,2	7,2
USA	56	96,9	6,7

International comparison for milking speed and temperament among most important countries show that:

- Red breeds: DNK/FIN/SWE has a higher genetic level for milking speed and temperament than Norway and Canada
- Holstein: DNK/FIN/SWE has similar level as other populations for milking speed and temperament.
- Jersey: Denmark has similar genetic level as New Zealand and higher than USA

NTM for Nordic and foreign bulls

NTM index is calculated for all bulls (Nordic and others) that have official breeding values (NAV breeding values or international EBVs) for yield, udder health and conformation.

Interbull NTM is calculated by weighing the Interbull / NAV breeding values for yield, female fertility, calving (maternal and direct), udder health, longevity, feet&legs, udder, milking speed and temperament. The same economic weight factors are used as for NAV breeding values.

Rules for calculation of NTM based partly or entirely on international breeding values are stated below in order of priority.

1. **Bull has NAV breeding value for a trait**

If the bull has NAV breeding value for a specific trait, this is used in the calculation of NTM - no matter if the bull also has international breeding value for that trait.

2. **Bull has no NAV breeding value, but has an international breeding value for a trait**

If the bull does not have NAV breeding value for the trait, the international breeding value is used, provided that Interbull calculates international breeding values for that trait and the bull comes from a country which provides data for that trait.

3. **Bull has no NAV or no international breeding value for a trait**

For traits where no Interbull EBV is available or the bull has no Interbull EBV, and at the same time it is not tested in the Nordic countries, a pedigree index is used. Pedigree index is calculated as ½ (EBV_{sire} -100) +1/4 ($EBV_{maternal\ grand\ sire}$-100) +100. The contributions from the sire and maternal grand sire can be based on either NAV breeding values or international breeding values. If EBV_{sire} or $EBV_{maternal\ grand\ sire}$ are unofficial the pedigree index is set to 100.

Publication rules for NTM

All foreign and Nordic bulls that have Interbull breeding values for yield, udder health and udder get a public Interbull NTM. This NTM is calculated with a lower reliability than an NTM for Nordic proven bulls, where information for all traits is always available.

Genetic level for Interbull NTM

In tables 22-24 genetic level for Interbull NTM for Jersey, Red breeds and Holstein are shown. Bulls included are born in 2013 or later.

Table 22. Genetic level for NTM, Red breeds. Bulls born in 2013 or later.

Country	No. of bulls	Average	STD
Canada	24	-14,1	10,6
Germany	11	2,2	7,3
DNK/FIN/SWE	358	5,7	8,9
UK	5	-13,4	13,0
Norway	170	-8,2	10,4
USA	5	-27,6	3,3

Table 23. Genetic level for NTM, Holstein. Bulls born in 2013 or later.

Country	No. of bulls	Average	STD
Australia	24	-8,6	9,1
Belgium	25	2,6	11,4
Canada	226	4,5	9,4
Switzerland	14	-2,9	9,8
Czech Republic	27	1,2	7,2
Germany	464	5,1	9,0
DNK/FIN/SWE	358	8,8	8,7
Spain	71	-3,2	7,8
Estonia	25	-11,8	7,3
France	260	1,6	8,1
UK	89	4,4	9,9
Hungary	5	1,4	6,3
Ireland	59	-8,9	8,2
Italy	263	1,1	8,3
Japan	45	-0,5	8,9
Netherlands	573	2,8	9,6
Poland	72	-7,8	8,7
Slovenia	22	-17,2	9,3
USA	978	9,0	8,7

Table 24. Genetic level for NTM, Jersey. Bulls born in 2013 or later.

Country	No. of bulls	Average	STD
Canada	7	-14,7	9,5
DNK/FIN/SWE	81	5,5	8,3
USA	188	-6,1	7,7

International comparison of NTM among most important populations shows that:

- Red breeds: DNK/FIN/SWE is better than Canada and Norway
- Holstein: DNK/FIN/SWE and USA have the highest level
- Jersey: Denmark's average NTM is 11 index points better than USA

Changes since last run
In the evaluation in April 2020 the following changes are done compared to December 2019 evaluation. Only changes in major countries:

Yield
- Base change in: Germany (all breeds), Netherlands (all breeds), Italy (Holstein), Canada (Holstein), France (Holstein)
- RDC in Norway have rolling definition of HYS. Therefore, some bulls occasionally may lose EDC although the number of daughters stay the same
- Jersey in New Zealand have introduced new multi trait model. Cause a general drop in reliability
- Jersey in Australia change method for calculation of reliabilities, and make pedigree corrections based on genotype information has cause drops in information
- Holstein in USA introduce base change, pedigree corrections and herd-year minimum edits causing drops in information
- Holstein in Italy

Fertility
- Base change in: USA (Holstein), Italy (Holstein), Canada (Holstein), France (Holstein)
- RDC in Norway update genetic parameters. Further the rolling definition of HYS causes some bulls to occasionally lose EDC although the number of daughters stay the same
- Holstein in Germany use phenotypic data from 2000 onwards (used to be 1995 before)
- Holstein from Nederlands introduce base change. Further data edits for fertility are changed, which result in a decrease in information for some bulls
- Jersey in New Zealand have introduced new multi trait model. Cause a general drop in reliability
- Jersey in Australia makes pedigree corrections based on genotype information has cause drops in information

Calving
- Base change in: Nederlands (Holstein), Italy (Holstein), Canada (Holstein)
- RDC from Norway change data extraction so no calving's involving sires and dams from HOL, BSW and SIM are used causing drops in information. Genetic groups are removed from the model, whereas inbreeding is being included. Rolling cow base is introduced
- Jersey in Australia change method for calculation of reliabilities
- Holstein in Germany use phenotypic data from 2000 onwards (used to be 1995 before). Base change is introduced
- Holstein in USA use pedigree corrections and herd-year minimum edits causing drops in information. Base change is introduced
- Jersey in Australia change method for calculation of reliabilities, and make pedigree corrections based on genotype information has cause drops in information

Conformation
- Base change in: Nederlands (Holstein), USA (Holstein), Italy (Holstein), Canada (Holstein), France (Holstein)
- Jersey in New Zealand have introduced new multi trait model. Cause a general drop in reliability
- Jersey in Australia change method for calculation of reliabilities
- Holstein in Germany use phenotypic data from 2000 onwards (used to be 1995 before). Base change is introduced

Udder health

- Base change in: Canada (Holstein), Nederlands (Holstein), Italy (Holstein), France (Holstein)
- RDC in Norway have rolling definition of HYS. Therefore, some bulls occasionally may lose EDC although the number of daughters stay the same
- Holstein in Germany participate with with clinical mastitis data for the first time. Base change is introduced
- Jersey in Australia participate with with clinical mastitis data for the first time
- Holstein and Jersey from USA implement limit of 700 overall DIM maximum for usable lactation record (increased from 400 DIM). Implementation of minimum incidence levels for each event at 10% of the current incidence rate for herd-years with over 100 animals causing drops in information. Base change is introduced
- Jersey in New Zealand have introduced new multi trait model. Cause a general drop in reliability

Longevity

- Base change in: Nederlands (Holstein), USA (Holstein), France (Holstein) Canada (Holstein)
- RDC in Norway have rolling definition of HYS. Therefore, some bulls occasionally may lose EDC although the number of daughters stay the same
- Holstein in Germany use phenotypic data from 2000 onwards (used to be 1995 before)
- Jersey in New Zealand have introduced new multi trait model. Cause a general drop in reliability
- Jersey in Australia makes pedigree corrections based on genotype information has cause drops in information. Further change method for calculation of reliabilities

Milking speed and temperament

- Base change in: Italy (Holstein), Netherlands (Holstein), France (Holstein) Canada (Holstein)
- RDC in Norway have rolling definition of HYS. Therefore, some bulls occasionally may lose EDC although the number of daughters stay the same
- Holstein in Germany use phenotypic data from 2000 onwards (used to be 1995 before). Base change is introduced
- Jersey in New Zealand have introduced new multi trait model. Cause a general drop in reliability
- Jersey in Australia makes pedigree corrections based on genotype information has cause drops in information. Further change method for calculation of reliabilities

Genomic tested young Holstein bulls

In the tables below, only Holstein sires that have breeding values based on genomic information and no daughters is shown

Averages are only shown for countries with more than 20 bulls.

Yield

In tables 25 is a comparison of the genetic level of yield for bulls from different countries.

Table 25. Genetic level for yield traits, Holstein. Bulls born in 2017 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Belgium	69	107,8	109,3	107,5	108,2	8,7
Canada	392	114,7	121,7	116,8	119,1	7,1
Switzerland	7	106,9	114,6	106,9	109,9	8,2
Czech Republic	26	114,8	114,4	114,2	114,2	6,8
Germany	387	115,3	116,7	118,5	118,4	6,9
DNK/FIN/SWE	169	104,7	114,6	111,8	114,3	7,9
Spain	59	116,2	108,9	114,3	111,7	8,1
France	285	110,0	113,3	114,0	114,5	6,5
UK	24	107,3	123,2	114,0	119,0	6,8
Hungary	76	111,7	111,7	108,7	109,3	8,9
Italy	90	115,0	116,7	117,8	117,9	5,7
Netherlands	201	109,3	116,8	115,2	117,0	6,9
Poland	73	113,9	113,6	114,4	114,1	5,3
USA	926	115,3	123,5	117,4	120,3	7,0

International comparison for yield shows that DNK/FIN/SWE, has nearly similar level as other major countries

Conformation

The international genetic evaluation is done for 16 linear traits for Holstein. In addition, frame condition score and locomotion is included in this trait group.

Calculation of frame, feet&legs and udder follows same principles as for daughter proven bulls.

In tables 26 is a comparison of genetic level of composite conformation traits for bulls from different countries.

Table 26. Genetic level of conformation traits, Holstein. Bulls born in 2017 or later.

		Frame		Feet&legs		Udder	
Country	No	Average	STD	Average	STD	Average	STD
Belgium	69	113,8	8,0	102,8	4,0	111,7	6,1
Canada	392	112,0	9,6	99,8	3,9	115,0	7,8
Switzerland	7	121,3	9,6	101,1	6,8	125,9	8,0
Czech Republic	17	108,8	8,6	103,2	3,4	110,9	7,2
Germany	387	111,0	8,5	104,5	4,4	114,7	6,6
DNK/FIN/SWE	169	104,5	8,6	103,9	4,2	111,9	7,3
Spain	59	115,1	7,9	104,3	6,2	115,2	7,2
France	285	119,5	9,4	105,6	4,4	118,5	7,8
UK	24	103,1	8,2	99,7	3,7	109,4	7,2
Hungary	76	113,8	8,1	100,2	4,5	108,7	7,9
Italy	90	117,1	7,8	102,5	4,6	114,3	6,9
Netherlands	200	110,6	8,4	107,2	6,0	110,5	8,3
Poland	73	116,1	8,5	103,4	4,5	109,7	8,2
USA	926	107,7	8,8	100,4	4,1	111,4	7,8

International comparison for conformation traits among most important populations shows that DNK/FIN/SWE has lower genetic level for frame than most other populations. For feet&legs and udder there are only small differences between populations.

Somatic cell count and udder health

In tables 27 is a comparison of genetic level of udder health for bulls from different countries.

Table 27. Genetic level for udder health, Holstein. Bulls born in 2017 or later.

Country	No. of bulls	Average	STD
Belgium	69	99,9	5,1
Canada	392	101,2	5,1
Switzerland	7	101,1	5,2
Czech Republic	17	101,8	6,4
Germany	387	102,8	6,6
DNK/FIN/SWE	169	106,0	7,0
Spain	59	103,4	9,0
France	285	107,6	6,4
UK	24	102,2	5,9
Hungary	76	94,8	7,3
Italy	90	103,9	6,3
Netherlands	200	104,4	6,9
Poland	73	103,9	6,8
USA	924	100,5	5,0

International comparison for udder health among most important populations show that DNK/FIN/SWE and France have higher genetic level than other major European and North American populations

Longevity

In tables 28 is a comparison of genetic level of longevity for bulls from different countries.

Table 28. Genetic level for longevity, Holstein. Bulls born in 2017 or later.

Country	No. of bulls	Average	STD
Belgium	69	104,0	5,4
Canada	392	110,1	5,0
Switzerland	7	104,1	8,4
Czech Republic	17	108,5	4,5
Germany	387	114,4	6,1
DNK/FIN/SWE	169	115,0	6,4
Spain	59	110,3	6,1
France	283	110,0	6,3
UK	24	113,0	4,3
Hungary	76	102,0	6,4
Italy	90	108,0	4,9
Netherlands	200	110,9	6,5
Poland	20	105,2	7,3
USA	926	110,5	5,2

International comparison for longevity among most important populations shows that DNK/FIN/SWE has the highest level closely followed by Germany

Calving – maternal and direct

In Tables 29 the average genetic level for bulls is shown for different countries.

Table 29. Genetic level for calving, maternal and calving, direct, Holstein. Bulls born in 2017 or later.

Country	Calving, direct			Calving, maternal		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Belgium	69	98,6	4,5	10	105,2	4,9
Canada	391	100,7	4,2	392	106,9	4,7
Switzerland	7	97,6	4,4	7	98,0	7,4
Czech Republic	17	99,1	3,8	17	104,9	3,1
Germany	386	100,5	5,0	387	104,7	5,4
DNK/FIN/SWE	167	101,7	5,0	169	105,8	5,1
Spain	54	98,6	4,7	54	103,0	5,0
France	278	97,4	4,8	278	105,0	6,1
UK	24	101,7	3,4	24	107,3	3,2
Hungary	76	97,8	4,2	76	103,4	5,0
Italy	90	99,8	4,4	90	105,1	4,5
Netherlands	200	102,0	5,0	200	103,4	5,7
Poland	20	98,1	3,5	20	105,6	8,3
USA	919	102,9	4,2	926	108,6	4,6

International comparison for calving (direct and maternal) shows that DNK/FIN/SWE, has nearly similar level as other major countries

Female fertility

In Tables 30 the average genetic level for bulls is shown for different countries.

Table 30. Genetic level for female fertility, Holstein. Bulls born in 2017 or later.

Country	No. of bulls	Average	STD
Belgium	69	96,6	4,5
Canada	392	101,8	7,1
Switzerland	7	94,3	10,4
Czech Republic	17	98,4	6,7
Germany	387	101,8	7,1
DNK/FIN/SWE	169	107,9	7,7
Spain	59	100,2	6,5
France	281	99,9	6,6
UK	24	105,4	5,3
Hungary	35	97,6	6,3
Italy	90	101,0	6,7
Netherlands	200	99,5	7,8
Poland	73	96,1	6,9
USA	926	102,2	6,2

International comparison for female fertility among most important populations shows that DNK/FIN/SWE is in the top.

Milking speed and temperament

In Tables 31, the genetic level for bulls from different countries.

Table 31. Genetic level for milking speed and temperament, Holstein. Bulls born in 2017 or later.

Country	Milking speed			Temperament		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Belgium	10	95,8	5,5	9	105,9	11,5
Canada	392	101,0	2,0	386	105,7	3,0
Switzerland	7	103,4	2,3			
Czech Republic	17	98,8	3,8			
Germany	387	100,2	3,7	382	106,3	7,4
DNK/FIN/SWE	169	103,7	2,0	167	105,5	3,7
Spain	54	95,1	2,0	54	108,2	3,3
France	283	97,5	3,0	271	106,2	3,1
UK	24	103,1	1,6	23	106,9	0,8
Hungary	28	99,1	4,4	28	105,3	2,7
Italy	90	100,0	4,0	84	105,3	2,5
Netherlands	200	98,5	4,2	199	105,9	10,6
Poland	20	101,6	1,4	20	105,3	1,7
USA	923	102,7	2,3	911	106,0	4,2

For milking speed DNK/FIN/SWE are superior. For temperament there are only small differences between populations.

Changes since last routine run
In the routine evaluation in December 2019 the following changes are done compared to August 2019 routine evaluation:

Yield
- Base change in: Germany (Holstein), Canada (Holstein), Italy (Holstein), Nederlands (Holstein), France (Holstein)

Fertility
- Base change in: Germany (Holstein), Canada (Holstein), Italy (Holstein), Nederlands (Holstein), France (Holstein)

Calving
- Base change in: Germany (Holstein), Canada (Holstein), Italy (Holstein), Nederlands (Holstein), France (Holstein)

Conformation
- Base change in: Germany (Holstein), Canada (Holstein), Italy (Holstein), Nederlands (Holstein), France (Holstein)

Udder health
- Base change in: Germany (Holstein), Canada (Holstein), Italy (Holstein), Nederlands (Holstein), France (Holstein)

Longevity
- Base change in: Germany (Holstein), Canada (Holstein), Italy (Holstein), Nederlands (Holstein), France (Holstein)

Milking speed and temperament
- Base change in: Germany (Holstein), Canada (Holstein), Italy (Holstein), Nederlands (Holstein), France (Holstein)

Dates of publication of Interbull breeding values in 2020:

Table 32. Dates of publication in 2020

Month	Date
April	7
August	11
December	1

The indices can be found at the national databases in Denmark, Sweden and Finland 2-3 days after they have been published by Interbull.

Regards
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