

INTERBULL breeding values calculated December 2019

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.

Table of content

International breeding values for the traits and breeds shown in table 1 have been published 3.12.2019.

Current evaluation	
Daughter 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 routine 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 routine 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 2012 or later, that have more than 60 daughters in the genetic evaluation.

Table 2. Genetic level for yield traits, Red breeds. Bulls born in 2012 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Australia	15	94,9	93,7	92,1	92,3	12,5
Canada	34	89,8	90,4	85,9	87,4	7,9
Germany	11	99,8	105,3	99,5	102,6	9,6
DNK/FIN/SWE	343	101,2	102,5	103,2	103,3	7,6
Estonia	16	98,1	99,8	98,3	99,2	9,6
UK	8	88,5	94,4	84,5	88,9	8,1
Norway	285	94,8	94,3	95,2	94,8	9,3
New Zealand	30	87,8	91,8	86,9	89,4	9,6
USA	7	75,9	76,1	69,9	71,9	13,2

Table 3. Genetic level for yield traits, Holstein. Bulls born in 2012 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Australia	83	94,3	99,4	94,3	97,1	5,7
Austria	6	102,3	103,8	97,5	99,8	8,6
Belgium	40	102,9	103,7	101,7	102,5	9,0
Canada	692	107,4	107,5	104,6	105,5	8,3
Switzerland	118	91,5	97,6	91,6	94,9	9,2
Czech Republic	41	104,9	104,9	100,9	102,1	7,7
Germany	965	107,5	105,1	104,5	104,1	9,2
DNK/FIN/SWE	549	102,5	103,5	104,4	104,4	9,0
Spain	122	107,3	102,8	100,9	100,4	7,2
Estonia	40	100,4	96,3	94,1	93,7	6,6
France	493	104,2	101,6	102,6	101,7	7,8
UK	185	100,8	103,9	98,6	101,0	13,9
Hungary	7	107,3	103,9	102,1	101,9	6,7
Ireland	219	76,8	92,9	84,0	90,8	9,3
Israel	131	98,6	105,9	98,3	102,4	6,7
Italy	427	103,3	103,4	101,2	101,9	8,0
Japan	79	108,1	104,7	103,5	103,0	8,8
Luxembourg	9	107,0	107,4	102,3	104,0	12,5
Netherlands	1031	103,0	103,7	102,5	103,0	9,5
New Zealand	663	78,6	93,6	87,5	93,1	6,8
Poland	235	98,9	98,9	95,9	96,8	8,4
Slovenia	38	93,6	89,5	88,6	87,9	7,9
USA	3298	108,1	108,4	104,7	105,9	9,0

Table 4. Genetic level for yield traits, Jersey. Bulls born in 2012 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Australia	22	107,0	88,8	104,8	93,6	5,5
Canada	11	105,2	94,3	99,6	94,5	16,2
DNK/FIN/SWE	121	100,1	103,1	102,4	103,6	8,3
UK	6	99,5	86,5	93,3	87,2	13,1
New Zealand	464	96,6	88,6	95,8	90,9	7,7
USA	545	116,4	100,2	110,3	101,9	9,8

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 2012 or later.

Country	No. of bulls	Frame		Feet&legs		Udder	
		Average	STD	Average	STD	Average	STD
Canada	52	100,8	5,7	102,1	4,4	107,7	8,4
Germany	25	105,6	9,5	106,8	3,4	101,7	9,9
DNK/FIN/SWE	366	98,3	10,5	100,2	5,2	101,1	8,3
UK	11	105,4	7,3			108,0	8,1
Norway	155	103,7	7,4	98,6	4,6	87,2	8,0
USA	6	105,3	8,2	103,8	2,6	111,0	12,1

Table 6. Genetic level of conformation traits, Holstein. Bulls born in 2012 or later.

Country	No	Frame		Feet&legs		Udder	
		Average	STD	Average	STD	Average	STD
Australia	45	112,7	9,1	98,6	4,1	98,7	13,2
Belgium	42	112,8	12,5	103,6	6,3	106,1	10,8
Canada	604	115,7	9,8	101,2	5,6	111,2	9,4
Switzerland	152	113,4	9,4	100,0	5,4	108,0	8,0
Czech Republic	47	113,4	7,6	102,1	4,9	101,2	11,7
Germany	966	111,3	9,6	102,2	6,0	106,9	9,4
DNK/FIN/SWE	531	101,4	11,2	101,3	6,2	103,6	8,8
Spain	142	116,8	9,3	100,9	5,9	107,7	7,8
Estonia	41	105,4	5,8	100,1	5,4	92,8	10,4
France	457	114,2	10,6	101,1	5,8	108,1	9,0
UK	133	112,6	12,2	100,3	4,7	106,0	12,5
Hungary	8	112,9	10,5	102,0	6,5	104,4	8,0
Ireland	44	91,7	12,7	96,8	6,0	80,8	15,3
Italy	412	114,0	10,6	100,6	4,7	108,1	9,6
Japan	486	114,5	9,2	100,6	4,6	104,7	9,2
Korea	15	110,7	6,3	97,2	3,0	103,4	5,5
Luxembourg	8	110,5	7,2	101,4	2,2	102,1	6,5
Netherlands	926	110,7	10,2	103,0	6,3	105,3	9,7
New Zealand	633	85,1	10,1	105,0		91,0	
Poland	289	108,9	9,9	100,1	4,4	96,0	8,8
Slovenia	36	102,7	12,4	99,1	5,9	94,1	7,5
USA	1790	113,0	10,0	100,9	5,3	110,8	8,9

Table 7. Genetic level of conformation traits, Jersey. Bulls born in 2012 or later.

Country	No	Frame		Feet&legs		Udder	
		Average	STD	Average	STD	Average	STD
Australia	9	108,3	8,8	102,7	3,3	88,9	8,7
Canada	19	113,4	6,7	103,7	5,6	100,4	7,8
DNK/FIN/SWE	144	100,3	9,5	100,6	6,6	101,1	8,9
UK	8	103,1	6,4			100,9	7,1
USA	594	113,1	8,8	102,6	6,9	100,0	8,1

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 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 2012 or later.

Country	No. of bulls	Average	STD
Australia	14	96,2	8,0
Canada	8	95,4	6,8
Germany	13	96,9	9,3
DNK/FIN/SWE	397	100,8	8,7
Estonia	17	92,9	10,6
Norway	285	95,3	10,9
New Zealand	43	90,2	10,3
USA	9	92,7	12,2

Table 9. Genetic level for udder health, Holstein. Bulls born in 2012 or later.

Country	No. of bulls	Average	STD
Australia	121	94,4	8,3
Austria	7	99,0	8,3
Belgium	43	99,0	9,4
Canada	311	96,8	8,4
Switzerland	16	94,5	5,7
Czech Republic	46	97,2	7,9
Germany	987	97,3	9,2
DNK/FIN/SWE	502	102,3	7,8
Spain	150	94,7	8,2
Estonia	42	93,9	8,5
France	440	98,3	6,9
UK	110	95,9	8,6
Hungary	8	99,4	7,8
Ireland	214	95,1	9,7
Israel	135	99,0	9,4
Italy	400	97,2	8,6
Japan	410	93,4	8,2
Korea	31	90,9	5,8
Luxembourg	7	96,5	7,7
Netherlands	1023	98,6	7,8
New Zealand	734	90,8	8,7
Poland	318	94,3	8,9
Slovenia	42	93,6	9,1
USA	1056	98,7	8,4

Table 10. Genetic level for udder health, Jersey. Bulls born in 2012 or later.

Country	No. of bulls	Average	STD
Australia	19	89,1	6,4
Canada	10	86,3	12,2
DNK/FIN/SWE	125	100,6	7,2
UK	8	85,8	10,3
New Zealand	436	94,3	8,4
USA	673	91,3	8,4

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 2011 or later.

Country	No. of bulls	Average	STD
Australia	18	91,6	8,3
Canada	59	89,6	10,4
Germany	28	92,2	8,1
DNK/FIN/SWE	388	101,6	8,2
UK	11	78,9	5,8
Norge	389	90,7	7,8
New Zealand	68	85,5	5,7
USA	14	82,0	8,9

Table 12. Genetic level for longevity, Holstein. Bulls born in 2011 or later.

Country	No. of bulls	Average	STD
Australia	108	88,4	5,9
Austria	7	92,7	2,5
Belgium	62	99,3	8,9
Canada	856	98,4	9,3
Switzerland	179	88,7	7,9
Czech Republic	7	99,0	7,7
Germany	1258	99,7	9,4
DNK/FIN/SWE	640	102,3	8,4
Spain	197	96,0	6,6
France	692	92,8	7,7
UK	226	96,6	8,3
Hungary	11	95,3	5,8
Ireland	232	91,2	6,2
Israel	167	92,2	5,3
Italy	538	96,7	7,0
Luxembourg	12	98,1	8,9
Netherlands	1359	98,5	8,5
New Zealand	934	88,7	6,2
Poland	514	91,6	7,7
Slovenia	55	89,9	8,5
USA	3780	103,9	9,1

Table 13. Genetic level for longevity, Jersey. Bulls born in 2011 or later.

Country	No. of bulls	Average	STD
Australia	29	86,8	6,1
Canada	22	88,7	7,4
DNK/FIN/SWE	133	100,4	7,2
UK	9	86,3	6,2
New Zealand	626	90,6	5,7
USA	642	94,0	7,4

International comparison for longevity among most important populations shows that:

- Red breeds: DNK/FIN/SWE has higher level than the other populations
- Holstein: France have 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 2011 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 2012 or later.

Country	Calving, direct			Calving, maternal		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Canada	52	95,7	6,9	20	98,3	6,7
DNK/FIN/SWE	348	100,6	7,7	351	101,1	6,5
Norway	285	98,9	8,3	285	88,6	6,9
USA	5	89,4	9,2	0		

Table 15. Genetic level for calving, maternal and calving, direct, Holstein. Bulls born in 2012 or later.

Country	Calving, direct			Calving, maternal		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	130	94.9	6,0	4	97.3	8.3
Austria	8	93.9	8.1	6	94.5	8.5
Belgium	42	97,0	6.3	39	99.5	6.8
Canada	745	97.5	6.4	671	100.4	8.8
Switzerland	171	93.6	6.3	117	93.2	10.1
Germany	1018	97.5	7.1	893	98.9	9.2
DNK/FIN/SWE	551	101.3	7.2	545	102.1	7.7
Spain	97	95.6	4.7	56	98.7	4.8
France	528	97.5	7.2	470	101,0	9.3
UK	163	98.7	5.4	60	98.7	7.5
Hungary	8	98,0	5.6	5	97.2	5,0
Ireland	164	100.5	4.7	1	121,0	
Israel	46	96.5	6.2	137	96.1	5.9
Italy	444	95.3	6.7	170	96.7	8.1
Luxembourg	9	93.9	8.4	7	97.9	6.3
Netherlands	1010	97.2	6.4	848	97.7	8.4
New Zealand	725	99.6	5.1	1	99,0	
USA	3595	98.1	6,0	2832	105.1	6.8

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 2012 or later.

Country	No. of bulls	Average	STD
Australia	13	98,8	11,4
Canada	34	95,9	8,5
Germany	11	87,5	6,8
DNK/FIN/SWE	330	99,8	8,9
UK	8	101,5	4,2
Norway	274	113,5	8,9
New Zealand	30	99,5	5,7
USA	7	93,6	7,6

Table 17. Genetic level for female fertility, Holstein. Bulls born in 2012 or later.

Country	No. of bulls	Average	STD
Australia	75	88,4	7,9
Austria	6	93,2	14,0
Belgium	39	97,1	9,5
Canada	677	94,2	9,9
Switzerland	116	94,1	3,9
Czech Republic	37	95,9	2,5
Germany	870	93,9	9,2
DNK/FIN/SWE	552	101,9	10,6
Spain	66	91,0	7,8
France	437	93,6	8,4
UK	184	97,4	8,8
Ireland	159	107,7	3,6
Israel	116	98,0	2,6
Italy	400	93,0	7,8
Japan	79	88,2	8,1
Luxembourg	8	93,0	7,4
Netherlands	955	95,1	8,9
New Zealand	663	100,1	5,1
Poland	202	90,3	7,7
USA	3196	97,8	9,3

Table 18. Genetic level for female fertility, Jersey. Bulls born in 2012 or later.

Country	No. of bulls	Average	STD
Australia	19	90,7	8,8
Canada	10	91,3	11,8
DNK/FIN/SWE	139	101,2	10,6
UK	6	93,3	10,5
New Zealand	464	99,4	6,5
USA	529	86,9	11,5

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 and USA are the populations with the highest genetic level. However Ireland have the highest genetic levels
- 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 2012 or later are shown for Holstein, Red breeds and Jersey.

Table 19. Genetic level for milking speed and temperament, Red breeds. Bulls born in 2012 or later.

Country	Milking speed			Temperament		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	11	99,2	3,1	11	102,5	4,1
Canada	51	93,2	9,8	51	92,5	9,0
Germany	24	101,6	6,2	24	101,5	4,5
DNK/FIN/SWE	371	101,4	8,0	324	100,5	9,9
Norway	218	96,0	2,2	226	97,2	3,0
New Zealand	23	100,5	6,3	23	99,8	5,2

Table 20. Genetic level for milking speed and temperament, Holstein. Bulls born in 2012 or later.

Country	Milking speed			Temperament		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	88	103,2	6,6	88	101,5	5,8
Austria	8	94,0	6,1			
Belgium	25	95,8	9,1	24	102,5	9,1
Canada	508	100,2	9,1	500	103,8	8,5
Switzerland	159	94,0	7,4	159	99,0	7,2
Germany	809	98,8	9,3	650	102,8	10,9
DNK/FIN/SWE	535	99,6	9,0	348	102,4	14,7
France	392	97,5	9,0	390	103,2	9,5
UK	149	101,0	15,2	137	102,7	10,6
Italy	417	99,1	8,5	412	103,7	6,2
Luxembourg	8	103,2	10,1	6	100,1	2,9
Netherlands	798	96,9	9,9	758	102,5	9,0
New Zealand	668	103,9	4,7	668	99,1	2,6
Slovenia	43	96,1	5,6			
USA	730	101,0	11,2	711	105,9	10,4

Table 21. Genetic level for milking speed, Jersey. Bulls born in 2012 or later.

Country	No. of bulls	Average	STD
Australien	20	98,6	7,1
Canada	17	93,1	9,3
DNK/FIN/SWE	131	99,8	9,6
New Zealand	432	98,8	7,2
USA	51	95,8	7,6

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 than Norway and Canada. For temperament the levels are similar
- 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 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 $\frac{1}{2} (EBV_{\text{sire}} - 100) + \frac{1}{4} (EBV_{\text{maternal grand sire}} - 100) + 100$. 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 $EBV_{\text{maternal grand sire}}$ 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 2011 or later.

Table 22. Genetic level for NTM, Red breeds. Bulls born in 2012 or later.

Country	No. of bulls	Average	STD
Canada	18	-14,2	9,9
Germany	11	-1,4	7,8
DNK/FIN/SWE	342	5,5	8,5
Norway	156	-8,1	10,2

Table 23. Genetic level for NTM, Holstein. Bulls born in 2012 or later.

Country	No. of bulls	Average	STD
Australia	30	-9,6	8,2
Austria	5	-5,6	9,4
Belgium	40	1,5	10,4
Canada	346	1,5	9,5
Switzerland	18	-7,8	9,7
Czech Republic	41	-0,4	7,8
Germany	923	1,1	9,9
DNK/FIN/SWE	541	7,8	8,9
Spain	118	-4,4	8,1
Estonia	40	-12,1	7,4
France	423	-1,6	8,3
UK	137	1,6	9,3
Hungary	7	-2,0	5,9
Ireland	57	-9,0	8,6
Italy	396	-2,1	9,0
Japan	79	-3,6	9,6
Luxembourg	8	1,5	7,6
Netherlands	954	0,6	9,5
Poland	231	-11,1	8,7
Slovenia	38	-17,8	8,4
USA	1070	7,2	8,9

Table 24. Genetic level for NTM, Jersey. Bulls born in 2012 or later.

Country	No. of bulls	Average	STD
Australia	9	-15,1	3,7
Canada	7	-13,6	17,8
DNK/FIN/SWE	120	4,5	8,0
USA	455	-6,3	8,8

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 routine run

In the routine evaluation in December 2019 the following changes are done compared to August 2019 routine evaluation in major countries:

Yield

- RDC from Norway changed to a rolling cow base, based on cows born 3 to 8 years ago. Std is based on bulls born 5 to 12 years ago, but the limits will be updated only every second year
- All breeds from Germany have small changes in information due to data editing and pedigree correction
- Holstein from USA have change in information caused by data editing – mostly affecting old bulls

Fertility

- RDC from Norway delete old data in small herds. Further base is changed to a rolling cow base, based on cows born 3 to 8 years ago
- All breeds from Germany have changed editing resulting in some decrease in number of daughters
- Holstein from USA have drop in information due to editing of herds/daughters
- Jersey from New Zealand have drop in information due to changes in matings, calvings and DNA verification.
- Holstein from Italy have drop in information caused by data flow and data editing

Calving

- All breeds from Germany have small changes in information due to data editing and pedigree correction
- Holstein from USA have drop in information due to editing of herds/daughters
- Holstein from Italy have drop in information caused by data flow and data editing

Conformation

- RDC from Norway have changed to a rolling cow base, based on cows born 3 to 8 years ago
- Holstein from USA have small drop in information due to parentage correction

Udder health

- RDC from Norway have changed to a rolling cow base, based on cows born 3 to 8 years ago

Longevity

- RDC from Norway delete old data in small herds. Further base is changed to a rolling cow base, based on cows born 3 to 8 years ago
- All breeds from Germany have small changes in information due to data editing and pedigree correction
- Holstein from USA have change in information caused by data editing – mostly affecting old bulls
- Holstein from Italy have drop in information caused by data flow and data editing

Milking speed and temperament

- RDC from Norway have changed to a rolling cow base, based on cows born 3 to 8 years ago

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 2016 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Belgium	137	106,3	107,5	105,3	106,0	8,2
Brasil	5	108,0	114,8	106,6	109,4	6,4
Canada	591	116,2	119,8	116,8	118,1	7,0
Switzerland	16	103,5	105,9	102,4	103,4	6,6
Czech Republic	47	114,1	113,8	113,0	113,1	5,4
Germany	611	114,9	114,7	116,3	116,0	6,9
DNK/FIN/SWE	244	105,8	113,1	111,3	113,1	7,0
Spain	83	114,6	108,2	110,8	109,1	8,4
France	440	109,6	111,6	112,2	112,4	6,8
UK	46	106,4	116,2	109,4	112,7	13,7
Hungary	77	111,7	111,1	108,1	108,6	9,3
Ireland	5	67,0	85,6	76,0	81,8	5,0
Italy	167	113,6	115,0	115,1	115,4	6,1
Luxembourg	11	118,5	117,8	117,0	117,0	4,2
Netherlands	381	109,7	115,0	113,8	115,1	7,1
Poland	117	112,0	111,5	111,9	111,7	6,7
USA	1307	114,6	120,7	115,7	117,9	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 2016 or later.

Country	No	Frame		Feet&legs		Udder	
		Average	STD	Average	STD	Average	STD
Belgium	137	113,9	7,1	102,5	3,6	111,2	6,0
Brasil	5	113,2	6,3	100,4	4,4	105,2	5,5
Canada	591	113,8	9,0	100,7	4,0	115,2	7,4
Switzerland	16	117,4	8,5	102,1	3,5	118,5	7,6
Czech Republic	29	110,0	8,1	102,5	2,9	112,0	7,2
Germany	611	112,1	8,5	104,6	4,5	115,4	6,7
DNK/FIN/SWE	244	104,8	9,4	103,8	4,3	112,6	7,0
Spain	83	117,1	9,7	104,6	5,7	116,8	8,0
France	440	118,4	9,5	104,6	4,4	118,5	7,8
UK	45	105,2	9,0	100,6	3,9	109,1	9,1
Hungary	77	114,0	8,0	100,4	4,2	109,1	8,0
Italy	167	116,1	8,1	102,1	4,2	114,5	7,2
Luxembourg	11	114,6	7,6	102,8	3,5	114,7	7,3
Netherlands	380	110,0	8,7	106,2	5,4	111,0	7,9
Poland	117	114,3	8,6	102,6	4,6	109,0	7,2
USA	1307	110,4	9,0	101,1	4,0	112,2	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 2016 or later.

Country	No. of bulls	Average	STD
Belgium	137	99,2	5,5
Brasil	5	99,3	2,5
Canada	591	99,5	5,6
Switzerland	16	96,2	6,2
Czech Republic	29	99,1	6,9
Germany	611	102,0	6,5
DNK/FIN/SWE	244	106,1	6,8
Spain	83	103,8	8,5
France	440	106,9	6,3
UK	45	101,6	5,0
Hungary	77	94,2	7,8
Italy	167	101,7	6,9
Luxembourg	11	100,5	7,3
Netherlands	380	103,5	7,0
Poland	117	102,2	6,4
USA	1311	99,0	5,4

International comparison for udder health among most important populations show that DNK/FIN/SWE, Netherlands 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 2016 or later.

Country	No. of bulls	Average	STD
Belgium	137	103,3	5,2
Brasil	5	102,4	3,6
Canada	591	109,5	5,0
Switzerland	16	101,8	5,9
Czech Republic	29	111,7	5,4
Germany	611	112,8	6,5
DNK/FIN/SWE	244	114,6	6,2
Spain	83	107,8	7,9
France	438	109,3	5,9
UK	46	110,4	6,9
Hungary	77	102,5	6,3
Ireland	5	89,1	3,5
Italy	167	107,3	5,5
Luxembourg	11	112,1	7,8
Netherlands	380	110,6	6,3
Poland	58	104,2	6,6
USA	1311	109,9	5,4

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 2016 or later.

Country	Calving, direct			Calving, maternal		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Belgium	134	98,4	4,4	21	104,6	6,3
Brasil	5	100,0	6,5	5	105,8	5,5
Canada	540	100,6	4,1	591	109,4	5,0
Switzerland	8	94,8	5,7	16	101,3	5,7
Czech Republic	29	99,2	4,3	29	108,3	3,9
Germany	531	100,7	5,1	611	105,9	5,4
DNK/FIN/SWE	200	102,5	4,9	244	107,1	5,4
Spain	79	98,8	4,4	79	103,0	5,4
France	433	98,7	4,8	434	106,0	6,3
UK	45	100,5	3,6	45	108,3	4,6
Hungary	77	98,3	4,3	77	105,2	5,0
Ireland	5	101,8	5,5	0		
Italy	167	99,3	4,8	167	106,3	5,2
Luxembourg	9	100,6	5,4	11	108,6	3,4
Netherlands	323	102,1	4,9	380	105,4	5,7
Poland	58	99,1	3,7	58	104,5	6,7
USA	1046	102,3	4,4	1307	110,4	4,8

International comparison for calving traits shows that DNK/FIN/SWE is the best population for calving and have a similar level as most other countries for calving, maternal.

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 2016 or later.

Country	No. of bulls	Average	STD
Belgium	137	96,8	4,4
Brasil	5	97,0	5,7
Canada	591	101,4	7,2
Switzerland	16	98,8	7,9
Czech Republic	29	100,5	7,6
Germany	611	100,4	7,1
DNK/FIN/SWE	244	107,1	7,4
Spain	83	96,7	7,7
France	436	99,5	6,6
UK	42	105,9	7,7
Hungary	32	97,9	6,2
Ireland	5	114,2	4,3
Italy	167	99,6	6,9
Luxembourg	11	97,5	6,8
Netherlands	380	100,2	7,2
Poland	117	96,1	7,4
USA	1307	101,5	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 2016 or later.

Country	Milking speed			Temperament		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Belgium	19	98,5	4,9	15	107,8	2,3
Brasil	5	95,2	1,1			
Canada	591	101,2	3,1	574	107,0	4,2
Switzerland	16	101,1	3,7			
Czech Republic	29	102,9	4,1			
Germany	611	100,1	3,8	604	106,0	7,0
DNK/FIN/SWE	244	102,6	3,4	237	105,7	5,3
Spain	79	96,7	2,2	78	106,8	1,5
France	432	98,3	2,6	427	106,4	4,3
UK	41	101,8	2,0	40	107,8	1,6
Hungary	32	99,6	3,3	29	106,7	2,2
Italy	167	100,2	4,1	160	106,1	5,2
Luxembourg	11	99,9	1,7	11	104,8	1,6
Netherlands	380	98,6	4,3	376	105,7	9,8
Poland	56	98,5	2,5	44	104,2	2,4
USA	1308	102,6	3,1	1285	107,3	5,1

For temperament and milking speed 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

- Holstein from Netherlands have added new EDC from a new validation affecting reliability and standard deviation
- Holstein from Spain have stopped incorporating candidates and culled bulls older than 2 years old in the genomic evaluation

Fertility

- Holstein from Netherlands have added new EDC from a new validation affecting reliability and standard deviation
- Holstein from Spain have stopped incorporating candidates and culled bulls older than 2 years old in the genomic evaluation

Calving

- No change

Conformation

- Holstein from Netherlands have added new EDC from a new validation affecting reliability and standard deviation
- Holstein from Spain have stopped incorporating candidates and culled bulls older than 2 years old in the genomic evaluation

Udder health

- Holstein from Netherlands have added new EDC from a new validation affecting reliability and standard deviation
- Holstein from Spain have stopped incorporating candidates and culled bulls older than 2 years old in the genomic evaluation

Longevity

- Holstein from Netherlands have added new EDC from a new validation affecting reliability and standard deviation
- Holstein from Spain have stopped incorporating candidates and culled bulls older than 2 years old in the genomic evaluation

Milking speed and temperament

- Holstein from Netherlands have added new EDC from a new validation affecting reliability and standard deviation

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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