INTERBULL breeding values calculated December 2017

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 05.12.2017.

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 2010 or later, that have more than 60 daughters in the genetic evaluation.

Table 2. Genetic level for yield traits, Red breeds. Bulls born in 2010 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Australia	14	95,9	97,6	95,2	96,0	7,2
Canada	27	87,0	86,7	81,0	82,1	9,9
Germany	16	96,9	98,4	95,9	96,8	6,0
DNK/FIN/SWE	422	102,2	102,4	103,4	103,3	7,1
Estonia	18	97,6	96,8	95,6	95,7	9,4
UK	6	80,5	80,0	73,2	74,3	5,1
Norway	286	96,2	94,5	96,7	95,9	8,7
New Zealand	25	86,8	90,6	85,9	87,6	10,2
USA	10	77,0	65,8	63,9	62,1	11,0

Table 3.Genetic level for yield traits, Holstein. Bulls born in 2010 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Australia	97	95,6	99,1	96,1	97,5	7,4
Austria	5	103,2	97,6	94,2	94,0	3,9
Belgium	38	104,1	103,8	101,9	102,3	7,9
Canada	722	107,3	107,2	104,7	105,2	8,8
Switzerland	52	100,2	101,2	98,3	99,1	8,2
Czech Republic	39	103,4	102,1	99,8	100,1	8,5
Germany	815	106,2	104,9	104,0	103,9	8,2
DNK/FIN/SWE	671	102,4	103,1	104,0	104,0	8,2
Spain	147	104,0	101,4	98,7	98,7	8,3
Estonia	71	95,3	98,2	93,3	94,9	7,6
France	685	106,3	103,1	105,1	104,1	7,2
UK	211	103,1	103,1	99,8	100,4	9,0
Ireland	164	80,2	95,2	86,6	91,4	10,6
Israel	116	98,4	104,4	98,5	100,8	6,6
Italy	710	102,7	101,6	99,4	99,6	7,9
Japan	118	109,2	103,2	104,1	102,8	8,3
Luxembourg	6	105,3	107,2	104,2	105,5	7,6
Netherlands	965	104,5	104,2	103,6	103,6	9,0
New Zealand	748	79,8	95,3	89,2	93,5	7,2
Poland	430	99,5	99,7	97,0	97,6	7,6
Slovenia	38	94,2	91,7	90,1	89,9	6,5
USA	3594	107,8	106,2	104,1	104,2	8,8

Table 4.Genetic level for yield traits, Jersey. Bulls born in 2010 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Australia	26	103,4	93,4	100,3	96,0	7,0
Canada	11	104,8	88,5	99,3	92,2	17,7
DNK/FIN/SWE	138	101,2	102,7	102,5	103,1	8,5
UK	5	98,4	89,4	94,2	90,8	7,7
New Zealand	482	98,4	89,8	98,6	94,3	7,3
USA	532	117,7	102,9	113,0	106,6	8,8

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, France, Germany, USA, and Netherlands have similar genetic level
- Jersey: Denmark has slightly lower 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 is 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 2010 or later.

Country	No. of bulls	Frame		Feet&legs		Udder	
		Average	STD	Average	STD	Average	STD
Canada	56	105,4	5,3	101,8	3,7	107,9	7,3
Germany	23	109,4	6,8	104,3	3,4	103,8	8,4
DNK/FIN/SWE	478	97,7	8,6	98,6	5,3	100,9	8,3
UK	11	101,5	6,6			106,0	10,0
Norway	286			98,2	4,6	90,3	8,7
USA	9	106,3	8,3	100,6	3,2	112,6	11,9

Table 6. Genetic level of conformation traits, Holstein. Bulls born in 2010 or later.

Country	No	Frame		Feet&legs		Udder	
		Average	STD	Average	STD	Average	STD
Australia	54	112,4	9,2	99,1	5,0	97,1	12,0
Belgium	36	111,5	11,8	100,5	7,7	106,5	11,7
Canada	674	116,6	10,0	100,8	5,6	108,3	10,4
Switzerland	56	117,0	10,7	99,4	6,1	103,9	11,5
Czech Republic	48	111,8	8,9	101,9	5,8	98,4	8,9
Germany	853	110,8	10,3	101,0	6,3	104,5	10,1
DNK/FIN/SWE	651	100,9	11,6	100,3	6,4	103,2	9,5
Spain	167	113,3	10,3	100,1	6,0	104,2	8,5
Estonia	72	104,0	8,5	97,3	5,0	87,8	11,5
France	647	114,2	10,5	99,5	6,0	104,1	10,2
UK	170	111,6	10,4	100,3	5,0	102,8	9,4
Hungary	5	111,0	6,0	102,0	2,5	101,8	7,3
Ireland	53	95,5	13,7	96,4	5,1	85,5	19,5
Italy	721	112,9	10,0	100,7	5,0	104,6	9,7
Japan	510	114,2	10,2	99,4	4,8	101,7	10,0
Korea	5	108,4	12,1	98,0	1,4	97,6	4,4
Luxembourg	8	108,3	8,3	102,1	4,1	105,1	6,4
Netherlands	914	111,7	10,9	101,9	6,4	104,9	10,5
New Zealand	659	86,8	9,8	106,6	9,3	102,9	13,0
Poland	533	107,2	10,0	99,3	4,9	95,1	9,3
Slovenia	36	101,9	8,7	98,7	7,0	91,2	9,1
USA	2322	112,8	10,3	101,2	5,2	108,9	9,2

Table 7. Genetic level of conformation traits, Jersey. Bulls born in 2010 or later.

Country	No	Frame		Feet&legs		Udder	
		Average	STD	Average	STD	Average	STD
Australia	12	104,6	6,7	101,7	5,6	87,7	7,9
Canada	28	114,6	5,3	109,6	7,8	98,2	7,8
DNK/FIN/SWE	147	100,8	9,3	101,3	7,1	100,5	9,6
UK	9	99,8	10,1	103,0	4,1	97,0	8,2
USA	587	112,9	7,7	103,5	7,3	96,3	8,6

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

- Red breeds: Canada have generally higher genetic level for frame, feet&legs and 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 an 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 better 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 2010 or later.

Country	No. of bulls	Average	STD
Australia	5	97,5	7,8
Canada	11	94,8	10,3
Germany	15	88,4	8,4
DNK/FIN/SWE	512	100,2	8,5
Estonia	17	88,8	8,9
UK	5	102,6	8,3
Norway	286	95,3	10,1
New Zealand	41	89,0	10,4
USA	20	91,7	7,8

Table 9. Genetic level for udder health, Holstein. Bulls born in 2010 or later.

Country	No. of bulls	Average	STD
Australia	143	94,6	7,0
Austria	5	100,2	5,2
Belgium	40	98,4	8,0
Canada	509	96,2	8,3
Switzerland	59	93,6	7,2
Czech Republic	46	96,8	6,8
Germany	867	96,1	8,3
DNK/FIN/SWE	667	102,5	7,8
Spain	174	93,9	8,3
Estonia	69	95,2	8,3
France	622	96,4	7,1
UK	137	95,6	7,7
Hungary	5	97,1	5,7
Ireland	178	94,9	8,9
Israel	119	100,1	8,2
Italy	642	96,2	7,9
Japan	451	91,9	8,3
Korea	7	94,4	8,4
Luxembourg	8	92,9	10,4
Netherlands	962	97,6	7,8
New Zealand	595	91,3	8,9
Poland	567	95,0	8,4
Slovenia	40	90,8	10,2
USA	3719	99,8	8,2
South Africa	5	93,4	3,3

Table 10. Genetic level for udder health, Jersey. Bulls born in 2010 or later.

Country	No. of bulls	Average	STD
Australia	12	91,7	7,6
Canada	10	82,3	5,2
DNK/FIN/SWE	153	101,6	8,0
UK	5	92,4	4,3
USA	613	89,0	8,8

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 and USA have higher genetic level than other major European populations 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 2009 or later.

Country	No. of bulls	Average	STD
Australia	17	87,8	11,7
Canada	62	90,0	8,7
Germany	16	85,9	9,4
DNK/FIN/SWE	406	99,8	8,2
UK	9	85,7	8,8
Norge	154	89,0	7,4
New Zealand	62	87,2	5,9
USA	22	81,6	7,4

Table 12. Genetic level for longevity, Holstein. Bulls born in 2009 or later.

Country	No. of bulls	Average	STD
Australia	128	89,0	9,6
Belgium	43	98,4	9,0
Canada	810	95,8	9,5
Switzerland	79	88,1	7,0
Czech Republic	56	96,4	7,9
Germany	868	95,5	8,7
DNK/FIN/SWE	724	100,9	8,5
Spain	228	96,6	7,3
France	959	93,6	7,8
UK	223	95,7	7,2
Hungary	12	95,7	6,9
Ireland	187	93,8	6,3
Israel	154	94,2	5,6
Italy	898	97,1	7,2
Luxembourg	6	93,1	7,2
Netherlands	1089	96,9	8,5
New Zealand	769	92,0	5,9
Poland	773	92,6	7,5
Slovenia	49	91,4	8,8
USA	3954	102,0	9,5
South Africa	6	97,5	6,1

Table 13. Genetic level for longevity, Jersey. Bulls born in 2009 or later.

Country	No. of bulls	Average	STD
Australia	44	88,1	5,1
Canada	34	88,4	7,5
DNK/FIN/SWE	131	99,9	7,1
UK	7	86,8	3,8
Ireland	6	84,0	4,5
New Zealand	524	89,2	5,3
USA	554	93,0	7,1
South Africa	5	84,3	4,0

International comparison for longevity among most important populations shows that:

- Red breeds: DNK/FIN/SWE has higher level than the other populations
- Holstein: Canada, Germany and 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 2010 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 2010 or later.

Country	Calving, direct			Calving, maternal		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Canada	55	94,7	9,1	14	96,4	6,4
DNK/FIN/SWE	460	101,4	9,4	309	101,3	8,1
Norway	286	100,4	10,1	286	91,6	7,3
USA	7	99,0	8,4	0		

Table 15. Genetic level for calving, maternal and calving, direct, Holstein. Bulls born in 2010 or later.

Country	Calving, direct			Calving, maternal		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	177	94,8	7,4	7	98,9	5,2
Austria	6	94,8	2,8	5	97,0	5,7
Belgium	32	99,8	5,1	30	99,0	7,5
Canada	691	97,2	6,5	623	98,4	7,8
Switzerland	55	95,2	5,5	42	97,6	5,3
Germany	767	96,8	6,5	704	97,4	7,6
DNK/FIN/SWE	614	101,5	7,5	578	101,8	7,3
France	641	97,4	7,4	547	99,6	9,3
UK	166	99,2	5,8	47	98,5	7,6
Hungary	5	96,2	3,5	4	100,8	4,2
Ireland	188	99,6	5,0	9	104,1	8,2
Israel	21	97,3	7,3	105	95,7	5,1
Italy	678	95,7	7,2	262	97,6	6,0
Luxembourg	9	92,3	6,7	7	98,4	8,4
Netherlands	783	97,5	6,2	685	98,0	7,0
New Zealand	598	99,6	5,1	8	94,0	8,5
USA	3597	98,2	6,1	3144	102,7	6,5

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 2010 or later.

Country	No. of bulls	Average	STD
Australia	13	96,5	5,7
Canada	26	97,3	9,5
Germany	16	94,6	6,5
DNK/FIN/SWE	378	99,1	8,8
UK	6	97,8	5,8
Norway	286	105,3	8,8
New Zealand	24	98,1	4,4
USA	10	95,0	8,8

Table 17. Genetic level for female fertility, Holstein. Bulls born in 2010 or later.

Country	No. of bulls	Average	STD
Australia	94	92,5	8,6
Austria	5	93,6	6,6
Belgium	32	99,5	7,9
Canada	692	93,3	9,9
Switzerland	48	94,2	4,3
Czech Republic	35	95,2	3,2
Germany	756	94,8	8,7
DNK/FIN/SWE	625	101,9	9,8
Spain	94	93,0	6,6
France	613	94,5	4,5
UK	199	95,1	8,1
Ireland	126	107,4	5,9
Israel	107	98,7	2,5
Italy	682	93,6	7,3
Luxembourg	6	94,3	8,5
Netherlands	857	94,6	9,0
New Zealand	561	103,5	5,1
Poland	282	92,5	7,1
USA	3489	98,5	9,7

Table 18. Genetic level for female fertility, Jersey. Bulls born in 2010 or later.

Country	No. of bulls	Average	STD
Australia	44	88,1	5,1
Canada	34	88,4	7,5
DNK/FIN/SWE	131	99,9	7,1
UK	7	86,8	3,8
Ireland	6	84,0	4,5
New Zealand	524	89,2	5,3
USA	554	93,0	7,1
South Africa	5	84,3	4,0

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 and New Zealand 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 2010 or later are shown for Holstein, Red breeds and Jersey.

Table 19. Genetic level for milking speed and temperament, Red breeds. Bulls born in 2010 or later.

Country	Milking speed			Temperament		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	16	93,9	2,8	16	101,9	4,2
Canada	54	92,0	9,7	53	89,4	7,1
Germany	23	102,6	6,1	23	102,4	5,1
DNK/FIN/SWE	466	101,6	7,3	398	101,4	8,4
Norway	233	97,2	1,4	237	99,9	2,0
New Zealand	25	99,1	4,9	25	98,2	3,8

Table 20. Genetic level for milking speed and temperament, Holstein. Bulls born in 2010 or later.

Country	Milking speed			Temperament		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	134	104,2	5,7	134	101,5	6,2
Austria	6	94,7	4,1			
Belgium	29	93,7	7,4	24	101,4	7,1
Canada	561	97,5	7,4	546	103,2	6,6
Switzerland	57	98,4	5,4	56	100,1	4,7
Germany	724	97,6	8,9	525	101,3	10,0
DNK/FIN/SWE	604	98,3	10,1	374	101,2	13,2
France	523	96,8	8,6	511	104,5	9,2
UK	165	98,2	13,3	151	99,6	8,5
Ireland	9	90,5	7,0			
Italy	651	96,7	7,0	586	102,1	5,3
Luxembourg	8	103,2	6,8			
Netherlands	735	98,0	10,0	640	101,6	8,9
New Zealand	698	103,9	6,2	698	99,5	3,7
Slovenia	41	96,2	5,8			
USA	606	98,7	10,0	578	105,2	9,2

Table 21. Genetic level for milking speed, Jersey. Bulls born in 2010 or later.

Country	No. of bulls	Average	STD
Australien	32	100,8	5,3
Canada	23	95,5	7,7
DNK/FIN/SWE	132	97,6	11,0
New Zealand	409	99,1	7,8
USA	50	98,2	8,2

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. For temperament the levels are similar
- Holstein: DNK/FIN/SWE has similar level as other populations for milking speed.
- 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 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 2010 or later.

Table 22. Genetic level for NTM, Red breeds. Bulls born in 2010 or later.

Country	No. of bulls	Average	STD
Canada	12	-23,4	12,7
Germany	16	-7,7	8,4
DNK/FIN/SWE	422	4,8	7,8
UK	5	-24,4	7,7
Norway	286	-8,7	8,5
USA	5	-30,8	8,6

Table 23. Genetic level for NTM, Holstein. Bulls born in 2010 or later.

Country	No. of bulls	Average	STD
Australia	43	-4,7	9,1
Belgium	37	2,1	6,7
Canada	499	-0,1	9,2
Switzerland	52	-7,7	8,3
Czech Republic	39	-2,6	6,6
Germany	795	-0,6	8,4
DNK/FIN/SWE	662	7,2	7,7
Spain	147	-6,5	8,4
Estonia	65	-10,6	7,4
France	570	-1,1	6,6
UK	188	-3,0	8,1
Ireland	62	-8,7	10,1
Italy	634	-4,7	7,9
Japan	118	-3,2	7,6
Luxembourg	6	0	7,3
Netherlands	906	0,6	8,2
Poland	430	-8,6	8,1
Slovenia	38	-14,9	7,6
USA	2546	4,8	8,5

Table 24. Genetic level for NTM, Jersey. Bulls born in 2010 or later.

Country	No. of bulls	Average	STD
Australia	12	-10,8	5,1
Canada	9	-15,8	15,8
DNK/FIN/SWE	137	3,9	9,0
UK	5	-14,0	7,2
USA	481	-3,8	9,4

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 8 index points better than USA

Changes since last routine run
In the routine evaluation in December 2017 the following changes are done compared to August 2017 routine evaluation:

Yield
- Denmark has merged HOL and RED
- RDC bulls from Norway may occasionally get lower reliability due to rolling definition of herd x year x season
- RDC from Germany has bulls that change proof type and some are not publishable
- RDC and HOL from Ireland change to test-day model
- Jersey and Holstein from New Zealand do continuous DNA parentage testing affecting daughters and reliabilities of bulls

Fertility
- Denmark has merged HOL and RED
- RDC bulls from Norway may occasionally get lower reliability due to rolling definition of herd x year x season
- HOL from Germany has excluded non-informative information
- RDC from Germany has bulls that change proof type and some are not publishable
- Holstein from Italy has changed editing – this might change information
- Jersey and Holstein from New Zealand do continuous DNA parentage testing affecting daughters and reliabilities of bulls

Calving
- Denmark has merged HOL and RED
- RDC bulls from Norway may occasionally get lower reliability due to rolling definition of herd x year x season
- HOL from Germany has changed editing – this reduces data and pedigree
- RDC from Germany has bulls that change proof type and some are not publishable
- Holstein from Italy has changed editing – this might change information
- Holstein from USA has deleted data for some herds because they do not meet the criteria in editing
- HOL from New Zealand has included recent information
- Jersey and Holstein from New Zealand do continuous DNA parentage testing affecting daughters and reliabilities of bulls

Conformation
- Denmark has merged HOL and RED
- RDC in Norway changes standardization at each evaluation due to a rolling base. It has influence on bulls breeding values
- RDC from Germany has changes status on some bulls, which causes that some bulls arenot publishable any more
- Jersey from New Zealand has changed evaluation for overall udder
- Jersey and Holstein from New Zealand do continuous DNA parentage testing affecting daughters and reliabilities of bulls

Udder health

- Denmark has merged HOL and RED
- HOL from Holland has introduced minor data editing
- RDC from Germany has bulls that change proof type and some are not publishable
- HOL from Italy has introduce a mastitis index

Longevity

- Denmark has merged HOL and RED
- HOL from Germany has excluded cows without culling date and with last calving date over 750 days
- RDC from Germany has bulls that change proof type and some are not publishable
- Holstein from Italy has changed editing
- Jersey and Holstein from New Zealand do continuous DNA parentage testing affecting daughters and reliabilities of bulls

Milking speed and temperament

- Denmark has merged HOL and RED
- RDC bulls from Norway may occasionally get lower reliability due to rolling definition of herd x year x season
- RDC from Germany has bulls that change proof type and some are not publishable
- Holstein from Italy has changed editing – this might change information
- Jersey and Holstein from New Zealand do continuous DNA parentage testing affecting daughters and reliabilities of bulls

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 2014 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Australia	12	110,1	108,5	104,6	104,9	6,7
Austria	5	118,0	108,0	113,6	110,6	3,5
Belgium	92	107,8	108,4	106,2	106,8	7,4
Canada	471	117,5	117,8	116,9	117,1	8,0
Switzerland	10	104,8	108,8	105,4	106,9	3,7
Germany	538	114,9	115,5	115,6	115,7	5,9
DNK/FIN/SWE	211	107,7	112,6	112,2	113,3	5,6
Spain	98	113,4	109,9	109,8	109,1	6,0
France	647	109,9	110,9	110,9	111,1	6,1
UK	80	102,2	108,4	103,6	105,9	22
Ireland	9	81,1	86,6	84,3	86,0	20,7
Italy	270	112,9	114,5	113,6	114,1	6,9
Luxembourg	8	116,8	116,1	116,1	116,0	2,7
Netherlands	308	112,9	115,2	114,2	114,9	6,5
Poland	141	107,8	108,5	107,2	107,6	7,2
USA	1553	115,9	118,6	116,0	117,1	6,2

International comparison for yield among most important populations shows that DNK/FIN/SWE, Canada and USA are a bit better other superior populations like Germany and Netherlands

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 2014 or later.

		Frame		Feet&legs		Udder	
Country	No	Average	STD	Average	STD	Average	STD
Australia	12	122,6	8,6	104,2	5,4	119,7	8,7
Austria	5	113,2	5,9	104,4	3,8	109,8	5,1
Belgium	92	115,2	8,1	102,5	4,5	111,1	7,2
Canada	471	119,0	8,5	104,1	3,6	116,9	8,3
Switzerland	10	119,4	6,0	103,8	4,6	121,4	6,7
Germany	538	114,8	8,3	105,4	4,8	116,6	8,3
DNK/FIN/SWE	211	105,1	10,0	103,9	5,1	115,0	8,3
Spain	99	119,7	10,1	103,9	5,5	115,7	8,0
France	648	118,9	9,2	104,7	4,9	118,1	7,9
UK	80	105,6	17,3	101,7	3,8	106,5	18,0
Ireland	6	92,7	21,1	96,5	6,8	87,5	24,2
Italy	270	116,8	7,9	103,5	4,3	114,1	7,9
Luxembourg	8	106,5	5,7	103,0	4,0	113,0	5,5
Netherlands	308	114,5	9,2	106,4	5,1	113,9	8,8
Poland	141	112,0	8,4	100,8	5,0	105,3	8,7
USA	1555	113,4	8,4	103,3	3,7	113,3	7,6

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 2014 or later.

Country	No. of bulls	Average	STD
Australia	11	97,1	4,6
Austria	5	96,7	5,1
Belgium	92	98,9	5,3
Canada	469	99,8	4,5
Switzerland	10	98,1	4,6
Germany	531	103,2	6,8
DNK/FIN/SWE	210	107,6	6,6
Spain	97	101,0	6,2
France	644	105,7	6,5
UK	76	101,1	4,0
Ireland	9	95,7	5,0
Italy	216	100,1	5,3
Luxembourg	8	102,0	5,6
Netherlands	304	104,7	7,1
Poland	141	99,6	7,1
USA	1551	99,9	4,3

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 2014 or later.

Country	No. of bulls	Average	STD
Australia	12	100,6	5,4
Austria	5	105,2	8,6
Belgium	92	101,5	6,4
Canada	471	107,7	5,5
Switzerland	10	103,4	4,5
Germany	538	109,9	6,1
DNK/FIN/SWE	210	112,3	5,5
Spain	98	104,5	6,7
France	639	106,0	6,1
UK	79	105,5	8,9
Ireland	6	92,2	11,9
Italy	270	106,5	5,7
Luxembourg	8	111,0	6,4
Netherlands	308	109,2	5,9
Poland	99	101,6	6,7
USA	1553	109,0	4,9

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

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 2014 or later.

Country	Calving, direct			Calving, maternal		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	11	96,1	7,6	12	103,2	7,1
Austria	5	99,0	3,1	5	103,0	8,0
Belgium	90	97,9	3,9	15	105,3	5,3
Canada	394	99,8	4,6	471	107,3	5,2
Switzerland	9	101,4	3,8	10	102,9	5,0
Germany	467	100,3	5,0	535	104,3	5,1
DNK/FIN/SWE	156	104,2	5,3	209	106,3	4,8
Spain	97	100,0	5,2	97	103,5	5,2
France	629	99,3	5,0	628	103,9	5,5
UK	76	100,5	4,5	74	104,1	6,1
Ireland	9	102,8	4,0	2	101,5	9,2
Italy	233	99,7	5,0	270	104,2	5,3
Luxembourg	8	100,9	6,0	8	104,5	4,8
Netherlands	267	101,7	5,6	307	104,6	5,5
Poland	91	99,4	5,3	91	101,6	5,8
USA	1206	101,2	4,6	1555	108,2	4,6

International comparison for calving traits among most important populations shows that DNK/FIN/SWE is the best population for especially calving, direct but also 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 2014 or later.

Country	No. of bulls	Average	STD
Australia	12	94.7	8.8
Austria	5	96.4	9.3
Belgium	92	98,0	5.1
Canada	471	100.5	7.4
Switzerland	10	98.5	9.5
Germany	538	99.4	7.3
DNK/FIN/SWE	211	107.5	8.4
Spain	99	96,0	9.5
France	645	98.9	7.9
UK	80	105.7	11.7
Ireland	6	109,0	16,0
Italy	270	99.2	7.8
Luxembourg	8	99,0	7.1
Netherlands	308	98.6	7.5
Poland	140	94.2	7.4
USA	1555	101.4	6.6

International comparison for female fertility among most important populations shows that DNK/FIN/SWE is the best country

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 2014 or later.

Country	Milking speed			Temperament		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	12	100,0	5,3	11	107,9	9,1
Austria	5	97,0	3,6	5	108,1	8,6
Belgium	15	100,2	6,2	11	105,4	7,9
Canada	470	101,6	4,4	419	108,4	6,6
Switzerland	10	96,8	5,4			
Germany	517	99,3	4,5	514	106,9	8,5
DNK/FIN/SWE	207	104,0	3,1	206	104,8	4,1
Spain	96	98,4	2,8	96	106,6	3,8
France	635	98,2	3,3	610	106,9	4,7
UK	79	101,5	4,5	66	106,6	7,7
Italy	270	100,5	5	253	106,5	9,0
Luxembourg	7	100,9	3,8	6	108,3	1,0
Netherlands	306	97,8	5,1	302	106,5	9,2
Poland	93	98,5	3,1	90	106,0	4,5
USA	1549	102,9	4,1	1411	108,3	6,5

International comparison for milking speed and temperament among most important populations show that for milking speed DNK/FIN/SWE and USA are the superior populations. For temperament DNK/FIN/SWE are among the populations with the lowest level

Changes since last routine run
In the routine evaluation in August 2017 the following changes are done compared to April 2017 routine evaluation:

Yield
- None

Fertility
- None

Calving
- None

Conformation
- None

Udder health
- None

Longevity
- None

Milking speed and temperament
- Holstein in Great Brittan has changed method for calculation of reliability

Dates of publication of Interbull breeding values in 2018:

Table 32. Dates of publication in 2018

Month	Date
April	3
August	7
December	4

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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