INTERBULL breeding values calculated December 2022

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 6th December 2022

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**	Young genomic tested bulls - HOL: Yield Conformation Somatic cell count and udder health Longevity Calving – maternal and direct Female fertility Milking speed and **temperament**

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 2015 or later, that have more than 60 daughters in the genetic evaluation.

Table 2. Genetic level for yield traits, Red breeds. Bulls born in 2015 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Australia	10	88,3	86,4	80,1	81,4	14,7
Canada	34	95,2	93,5	90,3	90,8	6,1
Germany	8	101,6	106,8	101,6	104,5	7,1
DNK/FIN/SWE	202	100,2	103,5	103,3	104,3	7,7
UK	7	76,6	79,3	69,4	73,1	8,2
Norway	119	97,1	96,1	96,0	95,8	9,6
New Zealand	21	89,6	93,2	85,8	89,0	8,6
USA	6	83,7	69,5	70,5	66,7	13,7

Table 3. Genetic level for yield traits, Holstein. Bulls born in 2015 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Australia	80	96,9	101,5	97,4	99,8	9,5
Belgium	18	105,6	106,0	104,7	105,2	6,6
Canada	462	109,9	109,4	107,7	108,1	10,1
Switzerland	94	98,2	99,3	97,8	98,6	7,8
Czech Republic	40	109,9	108,7	106,3	106,7	7,8
Germany	774	110,6	106,8	108,7	107,2	9,4
DNK/FIN/SWE	285	103,0	104,5	105,7	105,7	9,4
Spain	90	111,4	104,0	103,5	101,8	8,3
Estonia	7	92,3	93,1	89,1	90,4	9,6
France	346	104,8	102	104,4	103,0	8,2
UK	71	103,2	108,4	102,9	105,9	8,3
Ireland	57	74,2	88,1	81,7	87,0	9,7
Israel	129	101,3	102,7	100,2	101,3	7,0
Italy	293	106,8	104,5	104,7	104,1	8,2
Japan	44	110,5	108,8	107,4	107,5	7,1
Luxembourg	14	112,9	110,2	110,4	109,6	6,2
Netherlands	608	106,1	106,1	106,0	106,1	8,9
New Zealand	839	77,0	93,3	87,3	93,1	6,9
Poland	109	103,6	102,8	101,1	101,4	8,8
Slovenia	36	99,5	92,3	93,3	91,1	5,3
USA	2729	109,6	110,9	107,7	109,0	9,1

Table 4. Genetic level for yield traits, Jersey. Bulls born in 2015 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Australia	26	104,4	93,3	98,5	93,5	6,9
Canada	25	109,8	94,8	101,5	94,6	12,7
DNK/FIN/SWE	89	102,6	105,6	106,3	107,0	8,5
New Zealand	399	98,4	93,9	97,9	95,2	7,8
USA	434	116,0	99,7	109,6	101,2	10,3

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 higher genetic level than USA. New Zealand has considerably lower genetic level

Conformation

The international genetic evaluation is done for 16 linear traits for Holstein, Red breeds and Jersey. In addition, frame, body 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 2015 or later.

Country	No. of bulls	Frame		Feet&legs		Udder	
		Average	STD	Average	STD	Average	STD
Canada	42	103,1	8,9	103,1	4,2	101,7	8,6
Germany	10	110,1	6,0	105,4	4,5	104,9	9,3
DNK/FIN/SWE	210	98,3	11,1	100,7	5,2	101,2	8,3
UK	12	107,1	8,9			103,3	4,5
Norway	95	103,3	12,4	98,8	5,8	84,9	8,8

Table 6. Genetic level of conformation traits, Holstein. Bulls born in 2015 or later.

Country	No	Frame		Feet&legs		Udder	
		Average	STD	Average	STD	Average	STD
Australia	25	113,9	9,0	97,5	4,4	101,8	11,9
Belgium	17	110,2	13,8	104,0	7,7	103,6	9,5
Canada	382	116,3	10,9	98,2	6,3	112,5	9,4
Switzerland	104	112,7	7,9	98,9	5,5	108,0	9,3
Czech Republic	44	113,4	10,9	99,0	5,2	102,5	10,5
Germany	753	110,0	9,4	101,3	6,3	106,7	8,4
DNK/FIN/SWE	269	101,0	11,2	100,4	6,4	103,8	8,9
Spain	92	117,7	8,2	101,5	6,4	106,7	7,5
Estonia	9	107,2	7,5	97,6	4,8	90,3	12,3
France	312	117,0	9,9	102,2	5,4	108,5	7,9
UK	55	108,4	9,8	99,7	4,6	105,5	7,7
Ireland	30	89,8	11,4	96,0	3,6	74,9	13,4
Italy	284	113,3	9,7	100,1	5,7	106,4	8,5
Japan	368	114,0	9,4	99,2	5,4	102,8	8,4
Korea	12	112,0	5,1	99,6	3,8	98,1	5,3
Luxembourg	12	111,4	8,6	103,3	4,1	104,5	7,3
Netherlands	490	110,4	9,7	104,0	7,0	103,3	9,2
New Zealand	825	83,8	8,9				
Poland	94	110,8	7,4	100,1	5,0	96,6	7,7
Slovenia	36	105,7	11,1	100,0	5,6	94,8	7,1
USA	1612	110,5	10,7	98,2	5,8	107,2	9,0

Table 7. Genetic level of conformation traits, Jersey. Bulls born in 2015 or later.

Country	No	Frame		Feet&legs		Udder	
		Average	STD	Average	STD	Average	STD
Australia	13	107,0	4,7	100,7	7,7	90,4	6,1
Canada	29	110,1	8,8	105,6	7,3	101,3	9,0
DNK/FIN/SWE	90	101,2	8,2	100,5	7,1	101,4	9,4
USA	371	112,0	8,4	103,1	6,9	101,3	8,9

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

- Red breeds: Canada have similar genetic level for feet&legs and udder as 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 same genetic level for frame than most other populations. North America, Spain, France 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 2015 or later.

Country	No. of bulls	Average	STD
Australia	17	100,0	7,2
Canada	20	96,1	7,9
DNK/FIN/SWE	246	100,3	8,5
UK	6	99,3	12,2
Norway	120	99,5	10,0
New Zealand	37	93,0	7,3
USA	7	91,9	8,6

Table 9. Genetic level for udder health, Holstein. Bulls born in 2015 or later.

Country	No. of bulls	Average	STD
Australia	99	92,7	7,2
Belgium	17	97,2	9,2
Canada	240	98,5	8,6
Switzerland	25	96,2	8,7
Czech Republic	43	95,0	8,9
Germany	529	99,0	7,5
DNK/FIN/SWE	274	103,6	7,3
Spain	96	96,4	7,7
Estonia	8	92,2	5,3
France	306	99,0	7,7
UK	50	96,9	7,3
Ireland	57	92,6	9,2
Israel	133	99,5	8,8
Italy	271	96,5	8,7
Japan	304	91,1	8,1
Korea	31	91,6	5,9
Luxembourg	11	100,5	7,4
Netherlands	371	98,9	7,7
New Zealand	850	92,2	6,8
Poland	127	96,5	9,0
Slovenia	38	94,7	7,2
USA	1418	97,1	8,7

Table 10. Genetic level for udder health, Jersey. Bulls born in 2015 or later.

Country	No. of bulls	Average	STD
Australia	37	89,5	6,6
Canada	13	87,9	14,3
DNK/FIN/SWE	90	102,2	8,4
New Zealand	386	94,0	6,3
USA	201	87,7	7,8

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

- Red breeds: DNK/FIN/SWE has same genetic level as Norway
- Holstein: DNK/FIN/SWE have similar or 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 2014 or later.

Country	No. of bulls	Average	STD
Australia	13	91,0	11,7
Canada	50	91,9	9,2
Germany	17	94,2	7,9
DNK/FIN/SWE	209	101,2	7,9
UK	14	82,8	5,7
Norge	158	90,7	8,0
New Zealand	9	82,8	4,5
USA	7	79,3	9,3

Table 12. Genetic level for longevity, Holstein. Bulls born in 2014 or later.

Country	No. of bulls	Average	STD
Australia	95	89,3	8,6
Austria	8	97,0	6,3
Belgium	28	98,5	6,2
Canada	604	100,9	8,7
Switzerland	135	92,2	8,5
Czech Republic	54	103,7	6,9
Germany	1053	102,5	8,7
DNK/FIN/SWE	346	102,6	8,0
Spain	71	96,8	7,5
France	429	94,9	7,9
UK	90	100,8	9,3
Ireland	110	88,6	5,6
Israel	174	92,0	6,5
Italy	384	98,7	6,5
Luxembourg	15	104,7	7,9
Netherlands	778	101,7	9,1
New Zealand	818	86,2	5,5
Poland	136	98,4	8,9
Slovenia	50	93,5	6,6
USA	3237	103,7	9,0

Table 13. Genetic level for longevity, Jersey. Bulls born in 2014 or later.

Country	No. of bulls	Average	STD
Australia	33	93,3	7,1
Canada	24	91,1	8,3
DNK/FIN/SWE	60	100,0	7,5
New Zealand	231	90,4	4,6
USA	567	97,4	7,5

International comparison for longevity among most important populations shows that:

- Red breeds: DNK/FIN/SWE has higher level than the other populations
- Holstein: DNK/FIN/SWE are among the countries with the highest genetic 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 enough 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 2015 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 2015 or later.

Country	Calving, direct			Calving, maternal		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Canada	42	94,2	6,4	26	94,7	7,2
DNK/FIN/SWE	207	100,9	7,1	194	100,3	6,6
Norway	117	99,5	6,9	119	92,2	7,0

Table 15. Genetic level for calving, maternal and calving, direct, Holstein. Bulls born in 2015 or later.

Country	Calving, direct			Calving, maternal		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	98	96,6	5,5	1	100	
Austria	7	94,7	5,9	5	99,6	11,6
Belgium	21	99,2	4,9	17	101,5	7,4
Canada	494	97,7	5,8	389	102,5	5,7
Switzerland	115	96,2	5,2	93	98,1	8,2
Germany	820	98,0	6,0	738	99,7	7,3
DNK/FIN/SWE	287	101,0	6,6	283	102,2	6,6
Spain	30	97,7	4,5	33	100,3	4,4
France	378	96,9	6,4	334	103,3	8,5
UK	72	99,0	4,6	27	100,1	6,2
Israel	58	97,4	4,9	139	92,3	5,8
Italy	286	96,2	5,2	153	99,9	5,3
Luxembourg	17	97,2	4,4	14	102,9	6,2
Netherlands	562	98,5	6,3	470	98,6	8,4
New Zealand	671	101,2	4,6	0		
USA	2868	99,6	5,5	2080	102,8	5,6

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 2015 or later.

Country	No. of bulls	Average	STD
Australia	10	91,5	16,0
Canada	33	95,9	10,3
Germany	8	86,3	10,4
DNK/FIN/SWE	194	99,6	9,8
UK	7	94,3	6,8
Norway	104	114,0	8,1
New Zealand	21	98,0	6,6
USA	6	91,8	5,7

Table 17. Genetic level for female fertility, Holstein. Bulls born in 2015 or later.

Country	No. of bulls	Average	STD
Australia	74	93,3	8,3
Belgium	17	96,9	6,3
Canada	443	95,9	9,4
Switzerland	89	95,5	2,6
Czech Republic	36	97,4	3,3
Germany	696	94,8	9,1
DNK/FIN/SWE	281	102,7	11,6
Spain	51	91,7	7,9
France	316	96,5	8,0
UK	56	100,4	7,1
Ireland	57	107,0	3,1
Israel	127	96,7	2,6
Italy	271	95,0	7,3
Japan	44	92,5	5,9
Luxembourg	13	99,4	5,6
Netherlands	537	95,1	8,3
New Zealand	649	98,8	5,3
Poland	76	91,8	6,0
USA	2646	97,0	9,2

Table 18. Genetic level for female fertility, Jersey. Bulls born in 2015 or later.

Country	No. of bulls	Average	STD
Australia	40	89,8	7,4
Canada	28	86,7	12,5
DNK/FIN/SWE	146	100,5	12,1
New Zealand	431	96,6	7,5
USA	559	86,4	10,5

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 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 2015 or later are shown for Holstein, Red breeds and Jersey.

Table 19. Genetic level for milking speed and temperament, Red breeds. Bulls born in 2015 or later.

Country	Milking speed			Temperament		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	7	99,1	5,5	7	103,3	8,3
Canada	41	91,9	15,3	40	95,7	16,7
Germany	7	105,1	5,5	10	101,4	5,4
DNK/FIN/SWE	225	99,4	8,2	197	99,7	11,6
Norway	105	94,7	4,6	99	99,0	6,4

Table 20. Genetic level for milking speed and temperament, Holstein. Bulls born in 2015 or later.

Country	Milking speed			Temperament		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	59	100,7	5,2	59	101,1	5,9
Austria	7	95,2	6,5			
Belgium	16	96,6	13,2	17	101,3	12,1
Canada	299	98,5	11,4	296	104,8	10,8
Switzerland	111	95,5	9,3	111	100,0	9,6
Germany	588	97,7	9,8	507	101,9	14,1
DNK/FIN/SWE	277	100,3	7,6	227	101,6	16,1
France	299	96,6	10,5	295	103,7	10,8
UK	55	100,1	10,4	53	104,6	6,4
Italy	174	100,1	5,2	174	103,2	9,1
Luxembourg	10	92,1	7,6	6	98,0	15,5
Netherlands	377	95,6	12,3	358	102,7	11,7
New Zealand	798	103,3	4,3	798	96,7	3,0
Slovenia	38	96,4	5,8			
USA	731	100,7	12,3	701	105,0	11,1

Table 21. Genetic level for milking speed, Jersey. Bulls born in 2015 or later.

Country	No. of bulls	Average	STD
Australien	21	98,9	9,7
Canada	19	96,1	8,9
DNK/FIN/SWE	89	101,1	10,1
New Zealand	334	98,6	6,3
USA	33	98,5	10,5

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 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 2015 or later.

Table 22. Genetic level for NTM, Red breeds. Bulls born in 2015 or later.

Country	No. of bulls	Average	STD
Canada	23	-17,5	9,5
DNK/FIN/SWE	201	7,1	9,9
UK	6	-31,5	12,5
Norway	98	-5,5	9,7

Table 23. Genetic level for NTM, Holstein. Bulls born in 2015 or later.

Country	No. of bulls	Average	STD
Australia	25	-5,7	13,5
Belgium	17	3,6	7,3
Canada	263	4,9	10,8
Switzerland	73	-6,0	8,7
Czech Republic	40	4,0	7,9
Germany	551	5,0	9,1
DNK/FIN/SWE	278	10,4	8,6
Spain	89	-2,3	10,0
Estonia	7	-16,6	11,6
France	306	1,2	8,3
UK	52	4,5	7,1
Ireland	32	-15,4	10,2
Italy	273	0,2	8,6
Japan	44	1,6	7,8
Luxembourg	11	10,3	5,5
Netherlands	420	4,5	10,0
Poland	103	-4,9	9,1
Slovenia	36	-15,0	5,6
USA	1285	7,3	9,2

Table 24. Genetic level for NTM, Jersey. Bulls born in 2015 or later.

Country	No. of bulls	Average	STD
Canada	10	-12,0	7,0
DNK/FIN/SWE	88	8,7	8,2
USA	109	-8,1	7,3

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 more than 15 index points better than USA

Changes since last run

In the evaluation in December 2022 the following changes are done compared to August 2022 evaluation. Only changes in major countries:

Yield

- New Zealand (HOL) Continuous DNA parentage testing affecting numbers of daughters, herds and EDCs

Fertility

- Germany (HOL) Herd-years with uninformative NonReturn56, i.e., 100% NR56 are excluded. Some traits are verified with the subsequent calving, e.g. interval first to last insemination, insemination dates must match with calving dates and result in reasonable gestation length. Thus there are always some bulls having number of herds/daughters/EDC decreased, being not publishable anymore or in case number of herds drop below 10 herds, bulls are even not sent anymore.
- New Zealand (JER) Continuous DNA parentage testing affecting number of daughters, herds and EDCs. EDC also affected by changes in phenotype records.
- Italy (Holstein) Drop in information due to data editing

Calving

- Denmark, Finland and Sweden (HOL and RDC) New parameters have been estimated. Snell score is introduced for HV correction, Inbreeding in the A-matrix Inbreeding depression included in the model. Correction in the EDC calculation
- Italy (HOL) Drop in information due to data editing
- Holland (HOL) Applied to DCE only: Update of genetic parameters

Conformation

- Denmark, Finland and Sweden (JER) Overall udder score is a linear combination of udder traits, and the weights have been changed. No changes in linear udder tratits
- Norway (RDC) Testing all conformation traits without genetic groups in the model. Also applies to OFL and OUS
- New Zealand (JER) Continuous DNA parentage testing affecting daughters, herds and EDC counts. REDC count also affected by changes in phenotype records. Change in the conformation extraction where inspections done within 2 weeks from calving are now excluded (ICAR rule) causing drops in information
- USA (JER) Change in the weights used for the composite traits OUS and OFL

Udder health

- Germany (HOL) Changes in the phenotypic data resulted in a minor reduction of the number of daughters for 56 bulls. Some bulls are no longer included as they go below the required threshold for numbers of herds and daughters
- New Zealand (JER) Continuous DNA parentage testing affecting numbers of daughters, herds and EDCs. EDCs are also affected by changes in phenotype records

Longevity

- New Zealand (JER) Continuous DNA parentage testing affecting numbers of daughters, herds and EDCs. EDC are also affected by changes in phenotype records
- Italy (Holstein) Drop in information due to data editing

Milking speed and temperament

- New Zealand (JER) Continuous DNA parentage testing affecting numbers of daughters, herds and EDCs. Change in the extraction where data within 2 weeks from calving are now excluded (ICAR rule), this caused drops in information
- Italy (HOL) Drop in information due to data editing

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 2019 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Australia	21	107,7	111,0	107,9	109,0	8,9
Belgium	15	107,0	116,5	112,5	115,2	8,0
Brasil	10	121,6	112,0	113,7	111,5	6,7
Canada	485	111,6	123,4	114,5	118,6	10,1
Switzerland	30	103,0	105,6	103,3	104,2	10,0
Czech Republic	40	116,5	116,2	116,3	116,2	6,8
Germany	614	117,0	116,1	119,1	118,3	6,6
DNK/FIN/SWE	147	101,0	119,4	113,7	118,6	5,9
Spain	108	114,3	110,7	112,0	111,0	8,7
France	498	109,8	111,0	113,3	113,1	6,7
UK	54	100,3	114,8	105,1	109,9	22,5
Hungary	29	112,4	107,3	106,9	105,9	7,7
Italy	126	112,7	114,1	116,3	116,1	7,4
Netherlands	345	110,1	116,9	115,5	117,1	8,0
Poland	71	110,0	112,7	113,0	113,5	6,5
USA	1781	113,2	124,7	116,6	120,5	6,9

International comparison for yield shows that DNK/FIN/SWE, has same genetic 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 are 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 2019 or later.

		Frame		Feet&legs		Udder	
Country	No	Average	STD	Average	STD	Average	STD
Australia	21	116,7	10,9	98,2	4,4	111,6	8,3
Belgium	15	108,7	6,7	106,3	5,4	108,7	8,2
Brasil	10	109,2	5,0	95,6	2,7	105,3	7,1
Canada	485	115,0	11,1	99,4	4,7	110,2	9,2
Switzerland	30	117,5	9,1	100,3	4,7	120,7	5,8
Czech Republic	40	111,2	7,5	101,1	5,1	105,7	7,4
Germany	614	107,9	8,7	103,4	4,6	109,6	7,2
DNK/FIN/SWE	147	102,8	9,2	102,3	4,8	108,3	6,8
Spain	108	111,8	10,2	105,0	4,5	113,2	8,7
France	498	116,0	8,2	104,4	4,0	115,8	7,8
UK	54	102,0	12,3	98,9	3,6	98,7	16,2
Hungary	29	113,9	8,9	98,0	4,4	105,9	6,4
Italy	126	112,7	7,9	99,9	4,1	111,2	7,8
Netherlands	345	109,4	8,5	106,9	6,4	105,0	7,7
Poland	71	111,9	9,0	101,9	3,9	106,7	8,1
USA	1781	108,5	9,4	98,0	4,2	104,6	7,9

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 2019 or later.

Country	No. of bulls	Average	STD
Australia	21	96,7	5,8
Belgium	15	101,8	6,5
Brasil	10	95,6	3,9
Canada	483	98,4	4,9
Switzerland	30	100,4	5,8
Czech Republic	23	98,5	6,1
Germany	614	101,8	6,0
DNK/FIN/SWE	147	105,3	5,7
Spain	108	104,3	7,8
France	498	107,6	6,5
UK	54	98,0	5,0
Hungary	29	92,8	8,0
Italy	126	102,5	6,2
Netherlands	345	101,8	6,1
Poland	71	105,9	7,0
USA	1781	98,5	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 2019 or later.

Country	No. of bulls	Average	STD
Australia	21	102,5	5,9
Belgium	15	109,8	7,9
Brasil	10	107,1	3,2
Canada	485	108,6	6,2
Switzerland	30	105,4	7,3
Czech Republic	23	108,3	4,8
Germany	614	113,5	5,8
DNK/FIN/SWE	147	111,7	6,0
Spain	108	109,7	8,3
France	498	109,6	5,8
UK	54	105,7	10,1
Hungary	29	98,9	7,4
Italy	126	109,4	6,1
Netherlands	345	110,8	6,8
Poland	71	108,9	6,4
USA	1781	110,5	5,0

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

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, HOL. Bulls born in 2019 or later.

Country	Calving, direct			Calving, maternal		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	20	98,6	5,6	21	103,0	5,0
Belgium	14	100,6	2,8	15	102,1	5,1
Brasil	10	101,3	3,3	10	103,2	4,8
Canada	464	100,2	4,7	485	104,6	4,8
Switzerland	26	98,7	4,5	30	102,6	4,6
Czech Republic	22	99,5	4,4	23	104,0	5,1
Germany	543	100,4	4,3	614	102,3	5,0
DNK/FIN/SWE	123	101,1	4,9	147	103,0	4,7
Spain	108	99,2	5,2	94	100,9	4,9
France	498	97,6	4,4	496	102,6	4,9
UK	52	102,2	4,3	48	103,1	5,4
Hungary	29	97,1	2,9	29	101,6	2,3
Italy	126	99,8	3,8	126	103,8	4,3
Netherlands	296	101,7	4,2	345	101,9	5,3
Poland	71	97,1	4,2	71	101,1	4,8
USA	1589	101,6	3,8	1781	105,6	4,2

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 2019 or later.

Country	No. of bulls	Average	STD
Australia	21	99,9	5,7
Belgium	15	96,7	5,0
Brasil	10	99,3	5,5
Canada	485	97,9	6,2
Switzerland	30	101,1	7,9
Czech Republic	23	96,4	5,4
Germany	614	101,2	6,4
DNK/FIN/SWE	147	106,1	7,0
Spain	105	100,5	7,8
France	498	101,5	6,2
UK	54	103,5	6,0
Italy	126	101,6	6,4
Netherlands	343	99,6	7,3
Poland	71	101,2	8,2
USA	1780	100,7	5,6

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 2019 or later.

Country	Milking speed			Temperament		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	21	98,8	2,3	20	104,6	3,3
Belgium	15	97,4	3,6	14	102,9	6,3
Brasil	10	102,6	1,0			
Canada	485	100,7	4,9	431	106,7	6,7
Switzerland	29	100,5	3,6	7	99,3	1,3
Czech Republic	23	98,6	7,3			
Germany	599	97,5	5,3	588	104,5	8,8
DNK/FIN/SWE	147	100,7	3,2	144	104,5	6,0
Spain	105	95,4	4,1	89	103,9	2,8
France	493	94,6	2,6	486	105,6	7,2
UK	51	99,7	5,0	46	104,7	5,9
Italy	121	96,6	8,6	116	105,2	5,9
Netherlands	343	96,5	5,4	338	103,8	10,7
Poland	68	93,4	8,4	65	103,6	4,9
USA	1681	101,8	3,6	1631	106,0	6,0

For milking speed DNK/FIN/SWE are among the countries with the highest genetic level. For temperament there are only small differences between populations.

Changes since last routine run
In the routine evaluation in December 2022 the following changes are done compared to August 2022 routine evaluation:

Yield:
- No changes

Fertility:
- France: Proofs and reliability calculated with the single step methodology (HSSGBLUP) developped by INRAE. A new software for the count of daughters and herds has also been developed by Geneval. Principles stayed the same than before but pedigree corrections have been made. Other information concerning publication can have been changed

Calving:
- Holland: DCE in line with changes introduced in MACE

Conformation:
- France: Proofs and reliability calculated with the single step methodology (HSSGBLUP) developped by INRAE. A new software for the count of daughters and herds has also been developed by Geneval. Principles stayed the same than before but pedigree corrections have been made. Other information concerning publication can have been changed

Udder health:
- No change

Longevity:
- France: Proofs and reliability calculated with the single step methodology (HSSGBLUP) developed by INRAE. A new software for the count of daughters and herds has also been developped by Geneval. Principles stayed the same than before but pedigree corrections have been made. Other information concerning publication can have been changed

Milking speed and temperament:
- France: Proofs and reliability calculated with the single step methodology (HSSGBLUP) developed by INRAE. A new software for the count of daughters and herds has also been developped by Geneval. Principles stayed the same than before but pedigree corrections have been made. Other information concerning publication can have been changed

Dates of publication of Interbull breeding values in 2023:

Month	Date
April	4
August	8
December	7

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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