INTERBULL breeding values calculated December 2023

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 5th December 2023

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 2016 or later, that have more than 60 daughters in the genetic evaluation.

Table 2. Genetic level for yield traits, Red breeds. Bulls born in 2016 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Australia	13	88,1	84,9	80,7	81,3	14,2
Canada	29	94,7	92,9	90,2	90,6	7,1
Germany	7	101,7	106,6	102,4	104,9	5,0
DNK/FIN/SWE	185	99,9	103,8	103,3	104,4	7,5
UK	10	79,7	77,9	69,7	71,8	10,7
Norway	124	95,9	93,6	93,4	92,9	8,9
New Zealand	17	89,1	91,1	84,9	87,3	7,7
USA	6	78,8	73,5	69,2	69,3	17,5

Table 3. Genetic level for yield traits, Holstein. Bulls born in 2016 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Australia	54	97,1	104,0	99,5	102,6	9,4
Austria	5	111,2	99,0	104,0	99,4	10,5
Belgium	18	102,4	105,6	104,2	105,4	9,3
Canada	437	108,4	109,1	107,4	108,1	10,9
Switzerland	87	97,0	98,3	96,9	97,6	8,9
Czech Republic	41	108,1	107,3	105,2	105,8	8,9
Germany	745	109,5	105,4	108,0	106,2	9,5
DNK/FIN/SWE	265	100,5	102,9	103,6	104,0	9,0
Spain	76	111,4	103,7	104,5	102,4	7,3
Estonia	7	94,9	91,7	90,7	90,4	9,0
France	323	104,0	101,4	103,6	102,4	8,3
UK	44	100,1	108,5	101,6	105,8	8,4
Israel	120	100,1	101,5	99,3	100,3	6,2
Italy	198	106,4	104,9	105,8	105,2	8,4
Japan	32	109,3	108,8	106,2	106,9	6,5
Luxembourg	15	116,1	108,9	111,1	108,6	5,9
Netherlands	547	104,5	105,5	105,3	105,6	9,1
New Zealand	777	74,8	92,4	85,6	92,1	7,2
Poland	111	105,1	103,6	103,6	103,3	7,4
Slovenia	35	97,9	91,4	91,7	90,0	6,9
USA	2459	107,8	110,7	106,6	108,6	9,9

Table 4. Genetic level for yield traits, Jersey. Bulls born in 2016 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Australia	26	105,3	91,1	97,7	91,2	6,5
Canada	21	110,4	95,4	102,3	95,4	14,7
DNK/FIN/SWE	84	102,6	105,6	105,8	106,6	8,1
New Zealand	389	97,2	92,9	96,6	94,0	7,8
USA	403	115,6	99,9	109,1	101,2	10,7

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 2016 or later.

Country	No. of bulls	Frame		Feet&legs		Udder	
		Average	STD	Average	STD	Average	STD
Canada	36	102,9	9,2	103,1	4,8	101,3	9,0
Germany	10	107,5	11,6	105,8	5,4	103,5	6,6
DNK/FIN/SWE	189	97,8	11,1	100,8	5,0	101,3	7,5
UK	9	100,9	4,4			96,9	7,9
Norway	107	101,6	12,9	99,2	5,6	84,6	9,0
USA	6	110,0	8,5	105,2	3,7	109,0	10,0

Table 6. Genetic level of conformation traits, Holstein. Bulls born in 2016 or later.

Country	No	Frame		Feet&legs		Udder	
		Average	STD	Average	STD	Average	STD
Australia	15	120,9	15,3	100,2	8,0	111,7	17,3
Austria	5	100,6	8,7	103,0	2,0	107,2	7,2
Belgium	17	110,2	13,4	105,6	6,8	105,8	7,7
Canada	368	114,3	10,8	97,3	6,3	112,3	9,5
Switzerland	106	110,8	8,6	98,5	5,6	108,6	10,0
Czech Republic	44	110,7	10,5	99,5	4,0	104,1	9,0
Germany	741	108,6	9,5	101,9	6,3	107,5	8,1
DNK/FIN/SWE	248	100,7	10,6	101,2	6,0	104,5	8,7
Spain	82	114,4	8,7	101,8	6,7	107,3	8,3
Estonia	9	104,9	8,1	99,3	4,1	95,6	10,5
France	301	117,7	10,1	102,8	5,7	111,3	8,4
UK	33	103,6	11,2	98,7	4,0	103,6	7,3
Italy	197	113,1	10,4	100,1	5,3	106,7	9,2
Japan	353	112,2	10,0	98,6	5,4	102,8	8,3
Korea	12	110,9	7,0	100,1	2,4	99,5	5,7
Luxembourg	12	110,3	8,1	102,7	4,0	103,8	8,2
Netherlands	457	108,6	10,0	105,1	7,2	103,4	9,6
New Zealand	759	83,0	8,7				
Poland	85	111,7	9,1	101,2	5,7	99,6	8,5
Slovenia	34	105,8	12,1	98,4	6,0	93,5	6,3
USA	1521	108,0	11,0	97,9	5,8	107,1	9,2

Table 7. Genetic level of conformation traits, Jersey. Bulls born in 2016 or later.

Country	No	Frame		Feet&legs		Udder	
		Average	STD	Average	STD	Average	STD
Australia	8	107,4	6,5	103,6	7,0	92,3	5,3
Canada	27	110,6	8,7	105,4	7,1	99,6	9,0
DNK/FIN/SWE	86	100,6	8,8	99,4	7,8	100,8	9,6
USA	302	111,7	8,1	103,1	6,9	100,8	9,3

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 lower genetic level for frame than the main Holstein populations. North America, Spain, France and Italy have the highest genetic level for frame. Populations with grass based dairy farming like 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 2016 or later.

Country	No. of bulls	Average	STD
Australia	17	99,2	7,9
Canada	16	95,4	7,7
DNK/FIN/SWE	213	100,2	8,7
UK	6	99,9	9,0
Norway	126	99,7	9,6
New Zealand	26	90,8	6,7
USA	7	96,8	9,3

Table 9. Genetic level for udder health, Holstein. Bulls born in 2016 or later.

Country	No. of bulls	Average	STD
Australia	71	96,2	6,9
Belgium	16	99,3	9,0
Canada	251	98,6	8,2
Switzerland	23	99,1	8,7
Czech Republic	44	96,8	7,2
Germany	531	100,1	7,1
DNK/FIN/SWE	225	102,1	7,4
Spain	89	99,2	8,2
Estonia	9	98,4	8,9
France	276	101,9	7,6
UK	31	99,9	6,2
Israel	122	100,4	7,8
Italy	190	99,7	7,9
Japan	270	92,7	7,4
Korea	23	91,6	5,8
Luxembourg	9	100,7	7,3
Netherlands	341	100,6	7,5
New Zealand	804	93,1	6,5
Poland	121	99,6	8,7
Slovenia	35	96,4	7,9
USA	1451	98,0	8,6

Table 10. Genetic level for udder health, Jersey. Bulls born in 2016 or later.

Country	No. of bulls	Average	STD
Australia	31	91,9	5,9
Canada	14	79,3	12,5
DNK/FIN/SWE	68	101,4	7,4
New Zealand	365	94,9	6,1
USA	189	87,2	8,6

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 the other populations.

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 2015 or later.

Country	No. of bulls	Average	STD
Australia	9	88,6	13,1
Canada	43	88,3	11,5
Germany	13	95,8	6,8
DNK/FIN/SWE	190	101,2	9,0
UK	16	81,9	7,5
Norge	135	91,7	7,4
USA	10	76,7	7,1

Table 12. Genetic level for longevity, Holstein. Bulls born in 2015 or later.

Country	No. of bulls	Average	STD
Australia	77	90,4	9,2
Austria	9	99,5	8,6
Belgium	25	99,5	6,8
Canada	540	100,9	9,0
Switzerland	126	93,2	8,7
Czech Republic	58	103,3	6,3
Germany	964	103,0	8,6
DNK/FIN/SWE	298	102,6	8,1
Spain	62	96,1	6,6
France	391	97,8	7,5
UK	66	99,8	11,1
Ireland	57	89,8	6,1
Israel	167	92,4	6,1
Italy	284	97,9	6,7
Luxembourg	17	103,3	10,1
Netherlands	700	102	9,1
New Zealand	766	86,3	5,7
Poland	170	98,0	8,3
Slovenia	50	93,2	5,8
USA	3003	103,3	8,9

Table 13. Genetic level for longevity, Jersey. Bulls born in 2015 or later.

Country	No. of bulls	Average	STD
Australia	23	93,3	8,3
Canada	29	94,9	6,8
DNK/FIN/SWE	92	100,0	7,1
New Zealand	221	90,1	5,0
USA	504	98,6	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 the highest genetic level

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 2016 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 2016 or later.

Country	Calving, direct			Calving, maternal		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Canada	36	94,6	6,6	18	95,5	7,2
DNK/FIN/SWE	187	100,7	6,8	167	100,1	6,3
Norway	124	99,9	8,4	126	91,8	6,9

Table 15. 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
Australia	79	97,5	5,1	3	96,3	1,5
Austria	6	95,5	7,7	6	94,8	8,9
Belgium	19	98,0	5,1	19	100,0	6,5
Canada	466	98,2	5,5	363	102,0	5,0
Switzerland	113	96,8	5,3	86	99,1	8,1
Czech Republic	5	96,2	4,7	2	102,0	2,8
Germany	814	98,3	5,9	739	100,0	6,7
DNK/FIN/SWE	272	100,5	6,3	265	101,5	6,8
Spain	53	97,5	3,7	18	100,2	4,9
France	385	97,0	6,1	345	103,5	8,5
UK	41	99,6	3,8	22	100,7	6,0
Israel	55	96,5	4,3	125	91,7	5,3
Italy	193	97,5	4,5	133	100,2	5,2
Luxembourg	15	96,5	4,2	14	101,1	6,9
Netherlands	540	99,0	5,8	479	98,3	7,4
New Zealand	132	96,8	5,2	118	97,5	6,3
USA	2587	100,2	5,3	1883	102,7	5,0

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 2016 or later.

Country	No. of bulls	Average	STD
Australia	10	94,3	10,5
Canada	29	94,4	8,4
Germany	7	86,0	13,5
DNK/FIN/SWE	178	99,4	10,1
UK	9	93,0	4,3
Norway	110	113,1	6,9
New Zealand	13	97,1	7,0
USA	6	88,0	8,4

Table 17. Genetic level for female fertility, Holstein. Bulls born in 2016 or later.

Country	No. of bulls	Average	STD
Australia	43	95,4	8,1
Austria	5	90,8	7,7
Belgium	18	95,7	6,4
Canada	417	96,8	9,0
Switzerland	85	95,5	3,3
Czech Republic	33	97,8	3,8
Germany	671	96,2	9,5
DNK/FIN/SWE	267	103,1	11,3
Spain	42	91,3	6,0
France	273	96,2	7,9
UK	31	102,2	7,3
Israel	115	96,6	2,5
Italy	187	95,0	7,5
Japan	32	91,3	6,2
Luxembourg	14	96,6	9,3
Netherlands	506	95,0	8,9
New Zealand	598	99,6	4,8
Poland	67	92,2	6,5
USA	2352	97,5	9,4

Table 18. Genetic level for female fertility, Jersey. Bulls born in 2016 or later.

Country	No. of bulls	Average	STD
Australia	19	90,1	7,6
Canada	21	86,7	11,7
DNK/FIN/SWE	96	101	13,7
New Zealand	272	98,4	6,5
USA	381	87,8	10,0

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 have a high genetic 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 2016 or later are shown for Holstein, Red breeds and Jersey.

Table 19. Genetic level for milking speed and temperament, Red breeds. Bulls born in 2016 or later.

Country	Milking speed			Temperament		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	6	92,9	4,5	6	99,8	7,3
Canada	36	90,0	16,0	32	94,8	15,3
Germany	7	103,9	3,6	10	103,7	4,1
DNK/FIN/SWE	204	98,9	8,0	169	100,6	11,7
Norway	118	94,0	4,3	113	98,4	6,1

Table 20. 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
Australia	31	100,7	8,1	31	102,9	8,5
Austria	6	98,8	4,3			
Belgium	15	91,1	7,4	12	100,4	6,8
Canada	309	97,7	11,1	304	104,0	13,4
Switzerland	109	96,8	9,3	108	101,4	9,1
Czech Republic	5	104,7	8,9			
Germany	583	98,1	9,4	476	102,0	14,9
DNK/FIN/SWE	250	101,0	8,8	195	100,8	16,6
France	294	95,6	9,9	293	103,7	11,4
UK	33	100,0	9,6	33	103,8	5,9
Italy	190	95,2	3,9	188	103,1	7,9
Luxembourg	9	90,9	5,9			
Netherlands	405	94,7	10,6	349	102,5	13,4
New Zealand	758	103,2	4,0	758	97,4	3,2
Slovenia	38	94,8	7,0			
USA	769	99,9	12,0	742	103,9	14,4

Table 21. Genetic level for milking speed, Jersey. Bulls born in 2016 or later.

Country	No. of bulls	Average	STD
Australien	16	104,1	6,9
Canada	22	96,7	9,2
DNK/FIN/SWE	82	99,7	9,3
New Zealand	347	98,1	6,7
USA	22	100,2	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 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 2016 or later.

Table 22. Genetic level for NTM, Red breeds. Bulls born in 2016 or later.

Country	No. of bulls	Average	STD
Canada	17	-17,8	9,6
Germany	5	8,6	7,1
DNK/FIN/SWE	178	7,0	9,2
UK	6	-30,8	10,2
Norway	107	-8	9,8
USA	5	-31,2	9,8

Table 23. Genetic level for NTM, Holstein. Bulls born in 2016 or later.

Country	No. of bulls	Average	STD
Australia	10	0,1	8,7
Belgium	15	5,4	8,7
Canada	306	5,8	12,1
Switzerland	68	-5,9	10,2
Czech Republic	41	3,8	7,8
Germany	558	5,6	9,3
DNK/FIN/SWE	257	9,0	8,3
Spain	75	-0,3	7,9
Estonia	6	-16,2	11,6
France	281	2,1	8,9
UK	31	6,8	7,7
Italy	190	2,4	8,3
Japan	32	0,8	7,0
Luxembourg	9	6,2	6,0
Netherlands	390	4,9	9,8
Poland	101	-2,0	7,8
Slovenia	35	-16,3	7,6
USA	1345	7,4	10,1

Table 24. Genetic level for NTM, Jersey. Bulls born in 2016 or later.

Country	No. of bulls	Average	STD
Canada	6	-10,5	12,0
DNK/FIN/SWE	81	8,3	7,8
USA	35	-6,9	7,1

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 2023 the following changes are done compared to August 2023 evaluation. Only changes in major countries:

Yield

- France (ALL), all proofs sent to MACE are now "genomic-free" single-step proofs, issued from a BLUP evaluation running on single-step preadjusted performances, as suggested as one of the methods of choice to provide unbiased "genomic-free" proofs to Interbull by the Interbull working group on this topic. In addition to these changes, unknown parent groups have been modified for all traits.
- Denmark/Sweden/Finland (ALL) has updated way to define groups for animals with unknown parents (UPGs).

Fertility

- France (ALL), all proofs sent to MACE are now “genomic-free” single-step proofs, issued from a BLUP evaluation running on single-step preadjusted performances, as suggested as one of the methods of choice to provide unbiased “genomic-free” proofs to Interbull by the Interbull working group on this topic. In addition to these changes, unknown parent groups have been modified for all traits.
- New Zealand (ALL) cc2 and int: Change in model, definition of the traits, scale and heritability. New trait definition - PR42: confirmed pregnant within 6 weeks of planned start of mating (PSM), calculated from the days between PSM until date of conception (confirmed by the date of next calving) (expressed in days).
- Germany (HOL) has drop in information due to the data changing, some bulls don't meet the requirements to be included in the evaluation (daughters in less than 10 herd)
- USA (ALL) has drop in information (hco,cc1,crc) due to the pedigree correction and herd-year minimum edits.
- Netherland (ALL) has decrease in information (hco and cc1 maily for RDC) due to pedigree changes /correction.
- Italy (HOL) has drop in information (hco) due to pedigree editing.

Calving

- France (ALL), all proofs sent to MACE are now “genomic-free” single-step proofs, issued from a BLUP evaluation running on single-step preadjusted performances, as suggested as one of the methods of choice to provide unbiased “genomic-free” proofs to Interbull by the Interbull working group on this topic. In addition to these changes, unknown parent groups have been modified for all traits.
- New Zealand (HOL,RDC) will no longer participating.
- USA (HOL) has drop in information due to the pedigree correction and herd-year minimum edits.
- Netherland (HOL) has decrease in information due to pedigree changes /correction.
- Italy (HOL) has drop in information (msb) due to pedigree editing.

Conformation

- France (ALL), all proofs sent to MACE are now “genomic-free” single-step proofs, issued from a BLUP evaluation running on single-step preadjusted performances, as suggested as one of the methods of choice to provide unbiased “genomic-free” proofs to Interbull by the Interbull working group on this topic. In addition to these changes, unknown parent groups have been modified for all traits.
- New Zealand (ALL) has small decrease in information due to parentage verification.
- Netherland (HOL) has decrease in information due to pedigree changes /correction.

Udder health

- Australia (ALL) has decrease in information due to the data clean-up, pedigree changes, bulls' statue changes and rounding effect
- France (ALL), all proofs sent to MACE are now “genomic-free” single-step proofs, issued from a BLUP evaluation running on single-step preadjusted performances, as suggested as one of the methods of choice to provide unbiased “genomic-free” proofs to Interbull by the Interbull working group on this topic. In addition to these changes, unknown parent groups have been modified for all traits.
- Germany (HOL) has drop in information (Especially for MAS) due to the data changing, some bulls don't meet the requirements to be included in the evaluation (daughters in less than 10 herd)
- Netherland (HOL) has decrease in information due to pedigree changes /correction.

Longevity

- France (ALL), all proofs sent to MACE are now “genomic-free” single-step proofs, issued from a BLUP evaluation running on single-step preadjusted performances, as suggested as one of the methods of choice to provide unbiased “genomic-free” proofs to Interbull by the Interbull working group on this topic. In addition to these changes, unknown parent groups have been modified for all traits.
- New Zealand (HOL) has decrease in information due to parentage verification
- Canada (ALL) has drop in information due to to the data edits/changes.
- Netherland (HOL) has decrease in information due to pedigree changes /correction.
- Italy (HOL) has drop in information due to data flow and edits

Milking speed and temperament

- France (ALL), all proofs sent to MACE are now “genomic-free” single-step proofs, issued from a BLUP evaluation running on single-step preadjusted performances, as suggested as one of the methods of choice to provide unbiased “genomic-free” proofs to Interbull by the Interbull working group on this topic. In addition to these changes, unknown parent groups have been modified for all traits.
- Netherlands (HOL) has decrease in information due to pedigree changes /correction.
- New Zealand (HOL,JER) has decrease in information due to parent verification

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 2020 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Australia	85	98,3	108,2	102,1	106,5	8,1
Belgium	18	112,3	118,4	114,3	117,1	5,9
Canada	521	109,9	121,5	112,5	118,1	11,4
Switzerland	21	102,2	105,3	102,9	104,4	10,1
Czech Republic	48	114,4	115,9	114,3	115,2	6,3
Germany	628	115,8	115,8	117,7	117,2	7,4
DNK/FIN/SWE	141	99,5	119,7	113,3	120,3	8,2
Spain	96	112,9	109,5	110,8	109,5	10,1
France	510	109,2	109,4	112,0	111,3	7,6
UK	44	104,2	119,3	110,6	117,1	19,0
Hungary	29	111,2	107,5	106,1	105,6	7,3
Italy	110	113,0	115,1	116,5	116,6	8,2
Netherlands	497	109,1	115,7	114,4	116,5	7,9
New Zealand	6	71,5	90,7	84,8	91,3	7,5
Poland	82	111,6	112,0	113,9	113,4	7,1
USA	1900	111,4	124,7	115,6	121,7	7,3

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 2020 or later.

		Frame		Feet&legs		Udder	
Country	No	Average	STD	Average	STD	Average	STD
Australia	23	108,7	11,8	98,7	4,9	111,2	8,2
Belgium	18	110,2	9,3	106,7	5,6	110,2	7,7
Canada	521	116,0	11,9	100,3	5,1	110,9	9,0
Switzerland	21	122,7	8,4	102,3	3,7	121,7	7,3
Czech Republic	48	111,2	6,3	100,7	4,9	106,3	8,1
Germany	628	109,6	9,0	103,9	5,0	111,2	7,8
DNK/FIN/SWE	141	104,7	11,7	102,7	5,1	109,6	7,9
Spain	96	113,6	11,3	104,4	4,8	115,7	9,3
France	510	117,1	8,9	104,8	4,5	117,7	8,2
UK	44	103,7	10,5	97,9	3,3	98,7	13,3
Hungary	29	109,6	7,5	100,2	4,8	102,7	6,1
Italy	110	113,7	7,7	100,7	4,2	111,1	7,3
Netherlands	495	110,0	9,0	107,0	7,5	106,4	7,9
Poland	82	113,8	7,6	102,0	4,0	110,0	9,3
USA	1894	107,1	9,5	98,1	4,6	104,1	7,7

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 2020 or later.

Country	No. of bulls	Average	STD
Australia	22	98,8	4,4
Belgium	18	101,7	5,2
Canada	521	98,8	5,4
Switzerland	21	98,8	5,5
Czech Republic	38	99,2	5,8
Germany	628	102,6	5,8
DNK/FIN/SWE	140	104,5	5,5
Spain	96	103,3	7,0
France	447	107,8	6,2
UK	44	98,3	5,5
Hungary	29	93,8	4,6
Italy	110	102,6	6,1
Netherlands	495	101,6	6,2
Poland	82	106,1	6,4
USA	1894	99,6	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 2020 or later.

Country	No. of bulls	Average	STD
Australia	23	104,5	6,5
Belgium	18	108,2	5,2
Canada	521	106,5	5,9
Switzerland	21	102,6	7,3
Czech Republic	38	107,2	4,9
Germany	628	113,6	5,7
DNK/FIN/SWE	141	110,8	6,1
Spain	96	108,7	8,5
France	511	108,9	5,6
UK	44	105,9	8,1
Hungary	29	100,5	4,5
Italy	110	108,5	5,6
Netherlands	495	109,8	7,2
Poland	77	108,1	5,6
USA	1900	109,2	4,4

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 2020 or later.

Country	Calving, direct			Calving, maternal		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	21	99,8	4,4	22	104,2	3,4
Belgium	15	98,2	5,1	18	102,4	3,7
Canada	491	99,3	4,6	521	102,3	4,7
Switzerland	14	96,9	4,3	21	102,3	4,7
Czech Republic	37	99,4	4,4	37	102,6	5,2
Germany	564	100,4	4,0	628	101,8	5,0
DNK/FIN/SWE	124	100,0	4,4	141	101,2	4,4
Spain	96	99,4	5,1	96	99,7	5,2
France	447	98,4	3,9	447	101,4	4,8
UK	43	102,1	3,1	42	102,5	4,9
Hungary	29	98,1	3,9	29	99,8	2,8
Italy	110	99,7	3,8	110	101,7	3,8
Netherlands	448	100,8	4,0	495	100,8	5,0
Poland	82	97,1	4,2	82	100,8	4,7
USA	1697	101,2	3,6	1888	104,5	3,7

International comparison for calving (direct and maternal) shows that USA is best, and DNK/FIN/SWE has similar level as the 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 2020 or later.

Country	No. of bulls	Average	STD
Australia	23	103,3	5,0
Belgium	18	96,7	6,5
Canada	521	97,5	6,7
Switzerland	21	97,3	7,6
Czech Republic	37	97,5	6,2
Germany	628	102,2	6,3
DNK/FIN/SWE	141	105,7	7,3
Spain	96	100,0	8,2
France	447	102,5	6,4
UK	44	101,9	5,0
Italy	110	101,1	6,0
Netherlands	495	99,1	7,5
Poland	82	99,5	6,1
USA	1900	101,1	4,9

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 2020 or later.

Country	Milking speed			Temperament		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	21	103,6	5,8	16	106,6	2,7
Belgium	18	96,1	4,7	14	102,7	5,2
Canada	521	99,6	5,2	457	105,1	10,1
Switzerland	21	102,6	4,7	5	102,7	1,5
Czech Republic	38	99,3	5,0			
Germany	628	98,7	4,0	615	104,0	7,8
DNK/FIN/SWE	141	102,1	2,7	139	104,2	5,0
Spain	90	96,6	3,4	78	102,8	5,0
France	510	95,2	4,8	441	105,1	4,2
UK	41	101	7,2	35	104,4	4,7
Italy	110	95,9	8,5	100	103,9	7,0
Netherlands	475	97,1	5,5	462	103,3	10,5
Poland	69	92,7	13,6	64	103,6	7,9
USA	1871	100,8	3,3	1808	104,4	4,4

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 run
In the evaluation in December 2023 the following changes are done compared to August 2023 evaluation:

Yield:
- Denmark/Sweden/Finland has started a new system for handling genotypes. As consequence few bulls with genotypes have been deleted from the system
- Netherland has estimated SNP effects and DGTV with single step genomic system. GEBV are published from the pseudo-record system using DGV from the single step system. Reduction in reliabilities due to the fact that sires with a MACE EBV without Dutch/Flemish daughters genomics are no longer integrated on their MACE EBV.

Fertility:
- Denmark/Sweden/Finland has started a new system for handling genotypes. As consequence few bulls with genotypes have been deleted from the system
- Netherland has estimated SNP effects and DGTV with single step genomic system. GEBV are published from the pseudo-record system using DGV from the single step system. Reduction in reliabilities due to the fact that sires with a MACE EBV without Dutch/Flemish daughters genomics are no longer integrated on their MACE EBV.

Calving:
- Denmark/Sweden/Finland has started a new system for handling genotypes. As consequence few bulls with genotypes have been deleted from the system
- Netherland has estimated SNP effects and DGTV with single step genomic system. GEBV are published from the pseudo-record system using DGV from the single step system. Reduction in reliabilities due to the fact that sires with a MACE EBV without Dutch/Flemish daughters genomics are no longer integrated on their MACE EBV.

Conformation:
- Germany has for ANG a smaller reference population due to a recent change in the definition of the trait.
- Denmark/Sweden/Finland has started a new system for handling genotypes. As consequence few bulls with genotypes have been deleted from the system
- Netherland has estimated SNP effects and DGTV with single step genomic system. GEBV are published from the pseudo-record system using DGV from the single step system. Reduction in reliabilities due to the fact that sires with a MACE EBV without Dutch/Flemish daughters genomics are no longer integrated on their MACE EBV.

Udder health:
- Denmark/Sweden/Finland has started a new system for handling genotypes. As consequence few bulls with genotypes have been deleted from the system
- Netherland has estimated SNP effects and DGTV with single step genomic system. GEBV are published from the pseudo-record system using DGV from the single step system. Reduction in reliabilities due to the fact that sires with a MACE EBV without Dutch/Flemish daughters genomics are no longer integrated on their MACE EBV.

Longevity:
- Denmark/Sweden/Finland has started a new system for handling genotypes. As consequence few bulls with genotypes have been deleted from the system
- Netherland has estimated SNP effects and DGTV with single step genomic system. GEBV are published from the pseudo-record system using DGV from the single step system. Reduction in reliabilities due to the fact that sires with a MACE EBV without Dutch/Flemish daughters genomics are no longer integrated on their MACE EBV.

Milking speed and temperament:

- Denmark/Sweden/Finland has started a new system for handling genotypes. As consequence few bulls with genotypes have been deleted from the system
- Netherland has estimated SNP effects and DGTV with single step genomic system. GEBV are published from the pseudo-record system using DGV from the single step system. Reduction in reliabilities due to the fact that sires with a MACE EBV without Dutch/Flemish daughters genomics are no longer integrated on their MACE EBV.
- Italy, the national data recording system makes workability recordings available every six months. The data flow is not always constant, and some discrepancies are expected among runs.

Dates of publication of Interbull breeding values in 2023 and 2024:

Month	Date
December	5
April	2
August	13
December	3

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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