INTERBULL breeding values calculated August 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 9th August 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	9	87,9	84,6	79,3	80,1	14,4
Canada	30	94,2	92,0	89,2	89,5	7,3
Germany	7	100,4	104,9	100,6	103,0	6,4
DNK/FIN/SWE	192	100,1	103,6	103,4	104,4	8,0
UK	7	76,9	80,0	69,7	73,7	8,3
Norway	104	97,8	97,0	96,7	96,6	10,4
New Zealand	17	89,8	93,8	86,6	89,8	9,0

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	73	96,5	102,2	97,3	100,2	10,4
Belgium	17	106,1	106,4	105,5	105,8	6,5
Canada	425	110,4	109,6	107,9	108,2	10,2
Switzerland	86	98,8	99,7	98,2	98,9	7,9
Czech Republic	36	110,7	110,1	106,7	107,7	8,1
Germany	708	110,8	107,2	109,1	107,6	9,4
DNK/FIN/SWE	262	102,6	104,5	105,4	105,6	9,7
Spain	77	111,2	104,2	103,3	101,9	8,5
Estonia	7	93,9	94,4	90,0	91,4	8,6
France	305	105,0	102,3	104,7	103,4	8,3
UK	67	104,3	108,7	103,7	106,3	8,8
Ireland	57	74,5	88,5	81,9	87,4	9,7
Israel	117	101,8	103,7	100,9	102,3	6,6
Italy	270	107,2	104,6	105,0	104,3	8,4
Japan	39	109,8	109,1	106,9	107,4	7,4
Luxembourg	13	112,8	111,2	110,4	110,3	6,8
Netherlands	552	106,1	106,4	106,2	106,4	9,1
New Zealand	657	77,4	92,7	87,4	92,8	6,0
Poland	106	103,8	103,1	101,4	101,7	8,7
Slovenia	32	97,7	91,3	90,7	89,2	5,9
USA	2515	110,1	111,4	108,2	109,5	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	23	104,9	94,2	99,6	94,5	7,1
Canada	22	110,3	95,1	102,0	95,0	12,1
DNK/FIN/SWE	84	102,7	105,4	106,3	106,8	8,5
New Zealand	301	100,0	94,1	98,9	95,4	7,4
USA	396	116,7	100,1	110,3	101,8	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	39	102,9	8,9	103,1	4,0	100,9	8,1
Germany	9	111,2	7,2	105,3	4,6	104,3	9,7
DNK/FIN/SWE	199	98,3	11,0	100,8	5,2	101,4	8,4
UK	11	108,9	7,8			103,4	5,0
Norway	76	102,6	12,3	98,6	5,8	85,8	8,5

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	22	112,8	7,8	97,1	4,3	101,6	11,7
Belgium	17	110,4	13,7	104,1	7,4	104,2	9,2
Canada	348	116,5	11,2	98,3	6,4	112,8	9,2
Switzerland	98	112,8	8,1	98,9	5,5	108,1	9,5
Czech Republic	39	113,8	11,1	98,8	5,5	102,3	10,7
Germany	681	109,9	9,4	101,1	6,3	106,6	8,3
DNK/FIN/SWE	251	101,1	11,1	100,5	6,5	103,7	8,9
Spain	67	117,3	8,4	101,4	6,2	106,0	7,0
Estonia	9	106,9	7,5	97,6	4,9	90,3	12,5
France	285	116,8	9,9	102,2	5,6	108,6	8,1
UK	52	109,2	9,2	99,7	4,6	105,5	7,5
Ireland	30	90,3	11,1	96,0	3,8	75,1	13,3
Italy	265	113,1	9,8	100,0	5,7	106,6	8,5
Japan	317	114,2	9,4	99,5	5,4	103,0	8,3
Korea	10	111,2	6,1	99,4	4,0	98,0	5,0
Luxembourg	10	110,6	8,2	104,1	4,3	105,6	5,8
Netherlands	424	110,3	9,9	103,9	6,9	103,4	9,2
New Zealand	651	83,6	8,8				
Poland	91	111,2	7,4	100,1	5,0	96,6	7,6
Slovenia	30	105,2	11,2	99,6	5,8	94,3	6,8
USA	1479	110,6	10,5	98,3	5,7	107,4	8,9

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	11	106,7	6,2	99,7	8,0	90,1	5,5
Canada	26	110,5	8,9	105	7,4	99,6	8,8
DNK/FIN/SWE	84	101,3	8,3	100,5	7,0	101,9	9,1
USA	339	112,9	8,6	102,8	6,9	99,5	8,7

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	12	99,6	7,6
Canada	16	96,9	8,2
DNK/FIN/SWE	233	100,2	8,5
UK	5	97,1	12,5
Norway	105	99,7	9,9
New Zealand	35	94,8	6,8
USA	5	89,4	8,6

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

Country	No. of bulls	Average	STD
Australia	88	93,9	7,5
Belgium	12	95,3	9,6
Canada	218	98,8	8,3
Switzerland	22	96,3	8,9
Czech Republic	38	95,4	8,3
Germany	481	99,3	7,5
DNK/FIN/SWE	253	103,8	7,3
Spain	88	96,6	7,6
Estonia	7	92,9	5,5
France	273	99,2	7,7
UK	47	97,4	7,1
Ireland	57	92,7	9,2
Israel	121	99,7	8,7
Italy	249	96,4	9,0
Japan	276	91,1	8,2
Korea	23	91,5	5,2
Luxembourg	10	102,4	6,6
Netherlands	294	99,3	7,9
New Zealand	665	91,9	7,2
Poland	118	97,1	9,2
Slovenia	34	93,7	7,5
USA	1376	97,8	8,8

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

Country	No. of bulls	Average	STD
Australia	33	91,6	7,0
Canada	11	87,1	15,6
DNK/FIN/SWE	85	102,3	8,5
New Zealand	331	94,6	7,0
USA	194	87,8	7,9

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	90,8	12,0
Canada	43	91,7	8,7
Germany	15	93,9	7,4
DNK/FIN/SWE	196	101,3	7,6
UK	13	83,6	5,4
Norge	132	91,0	8,1
New Zealand	7	81,9	5,2

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

Country	No. of bulls	Average	STD
Australia	88	89,1	8,4
Austria	6	95,9	8,2
Belgium	27	98,7	6,5
Canada	564	100,7	8,3
Switzerland	127	91,9	8,1
Czech Republic	45	103,3	7,0
Germany	981	102,3	8,5
DNK/FIN/SWE	327	102,6	7,9
Spain	51	96,9	7,5
France	375	94,5	8,1
UK	82	101,3	7,9
Ireland	110	88,8	5,5
Israel	162	92,3	6,4
Italy	332	99,3	6,2
Luxembourg	14	105,3	8,7
Netherlands	718	101,7	8,9
New Zealand	551	85,6	4,9
Poland	131	98,6	8,7
Slovenia	46	93,7	7,2
USA	2969	103,6	8,8

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

Country	No. of bulls	Average	STD
Australia	27	92,2	6,8
Canada	23	91,3	7,6
DNK/FIN/SWE	55	100,0	7,9
New Zealand	154	90,5	4,7
USA	504	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	40	94,8	6,3	22	94,7	8,2
DNK/FIN/SWE	192	101,1	6,6	177	100,2	6,9
Norway	102	99,5	6,8	104	91,4	7,9

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	84	96,4	5,3	1	100,0	
Austria	7	94,4	6,4	4	101,0	14,1
Belgium	20	99,4	5,3	16	101,8	8,1
Canada	451	97,1	6,0	358	102,7	6,2
Switzerland	108	96,1	5,3	85	97,2	9,5
Germany	747	97,6	6,2	661	99,7	8,1
DNK/FIN/SWE	268	100,8	6,9	264	102,8	7,0
Spain	29	97,8	4,9	28	100,7	4,3
France	329	96,7	6,7	288	103,3	9,2
UK	67	98,7	4,9	20	99,6	7,5
Israel	52	98,3	5,3	127	91,9	6,5
Italy	264	95,9	5,9	137	100,5	5,6
Luxembourg	16	96,5	4,6	14	102,7	6,5
Netherlands	511	98,1	6,5	433	98,8	9,1
New Zealand	670	100,3	4,5	0		
USA	2652	99,1	5,6	1892	102,9	6,0

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 2015 or later.

Country	No. of bulls	Average	STD
Australia	6	85,3	18,0
Canada	27	97,1	10,7
Germany	7	84,7	9,8
DNK/FIN/SWE	185	99,7	9,9
UK	7	95,7	5,3
Norway	81	113,8	8,2
New Zealand	15	97,8	6,5

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

Country	No. of bulls	Average	STD
Australia	64	92,1	8,4
Belgium	17	96,6	6,4
Canada	408	95,8	9,0
Switzerland	85	95,4	2,6
Czech Republic	32	97,1	3,1
Germany	623	94,3	8,9
DNK/FIN/SWE	261	102,6	11,2
Spain	39	91,3	8,8
France	268	96,4	8,0
UK	52	100,2	7,0
Ireland	57	107,3	3,1
Israel	115	96,6	2,6
Italy	254	94,8	7,2
Japan	39	92,2	5,7
Luxembourg	11	100,0	5,6
Netherlands	484	94,7	8,2
New Zealand	451	98,9	5,3
Poland	69	91,7	6,1
USA	2421	96,9	8,9

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

Country	No. of bulls	Average	STD
Australia	38	90,7	7,7
Canada	26	86,3	11,8
DNK/FIN/SWE	141	100,4	12,5
New Zealand	333	96,6	7,8
USA	520	85,6	10,4

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	6	100,9	5,1	6	104,8	7,3
Canada	38	91,4	15,5	38	95,8	16,8
Germany	6	104,0	4,4	9	101,9	5,0
DNK/FIN/SWE	207	99,5	7,9	187	99,8	12,0
Norway	88	94,7	4,4	84	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	55	100,9	5,1	55	101,5	5,7
Austria	7	95,6	8,3			
Belgium	16	96,7	13,1	17	102,0	11,8
Canada	276	99,3	11,0	273	105,4	10,7
Switzerland	101	94,9	9,0	101	100,0	9,4
Germany	544	98,2	9,8	475	102,0	14,6
DNK/FIN/SWE	258	100,1	7,9	215	101,4	16,0
France	270	96,6	10,7	268	103,7	11,2
UK	52	100,5	10,2	50	104,9	6,5
Italy	242	100,8	4,8	242	103,9	8,1
Luxembourg	9	92,0	7,3			
Netherlands	353	95,9	12,3	333	102,9	12,6
New Zealand	657	102,6	2,9	657	96,4	2,4
Slovenia	37	97,0	6,2			
USA	664	101,9	11,6	631	105,5	11,4

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

Country	No. of bulls	Average	STD
Australien	20	98,4	9,8
Canada	17	94,5	8,4
DNK/FIN/SWE	84	100,7	10,3
New Zealand	281	98,7	6,2
USA	32	99,4	10,6

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 2015 or later.

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

Country	No. of bulls	Average	STD
Canada	21	-18,8	9,8
DNK/FIN/SWE	191	7,1	10,3
UK	5	-32,6	9,8
Norway	78	-5,7	9,3

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

Country	No. of bulls	Average	STD
Australia	23	-5,2	13,7
Belgium	14	4,4	8,9
Canada	244	5,6	11,6
Switzerland	62	-6,4	8,8
Czech Republic	36	5,0	8,0
Germany	491	5,6	9,1
DNK/FIN/SWE	254	10,1	8,3
Spain	62	-3,4	11,1
Estonia	7	-15,6	10,1
France	278	1,5	8,3
UK	51	4,8	6,9
Ireland	31	-14,1	10,1
Italy	250	0,6	8,7
Japan	39	1,5	7,9
Luxembourg	10	12,1	5,6
Netherlands	353	4,8	10,1
Poland	102	-3,9	9,2
Slovenia	32	-16,5	6,0
USA	1241	8,4	9,4

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

Country	No. of bulls	Average	STD
Canada	9	-12,9	5,9
DNK/FIN/SWE	83	8,1	7,9
USA	109	-7,5	7,8

International comparison of NTM among most important populations shows that:

- Red breeds: DNK/FIN/SWE is better than Canada and Norway
- Holstein: DNK/FIN/SWE and USA have the highest level
- Jersey: Denmark's average NTM is more than 15 index points better than USA

Changes since last run

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

Yield

- Norway (RDC) Rolling definition of effects redistribute the daughters and some bulls loose EDC
- USA (all breeds) Drops in information for most traits are due to pedigree corrections and herd-year minimum edits
- New Zealand (Jersey) Continuous DNA parentage testing affected daughter counts, herd count, EDCs, and reliabilities
- France (Holstein) Reliabilities are taken from single step model. This change can have the effect that some bulls do not meet publication rules anymore

Fertility

- Norway (RDC) Rolling definition of effects redistribute the daughters and some bulls loose EDC
- Denmark, Finland and Sweden (All breeds) Quality check editing on data causing drops in information
- Italy (Holstein) Drops in information for some bulls due to data edits
- USA (All breeds) Drops in information for most traits are due to pedigree corrections and herd-year minimum edits
- New Zealand (Jersey) Continuous DNA parentage testing affected daughter counts, herd count, EDCs, and reliabilities
- Germany (Holstein) Decrease in number of daughters, herds, EDCs and bulls changing publish status because of checking in the data
- France (Holstein) Reliability from the single step is now used as a factor of the publication

Calving

- Norway (RDC) Rolling definition of effects redistribute the daughters and some bulls loose EDC
- Denmark, Finland and Sweden (Jersey) Correcting the way the Interbull EDC calculation methods was implemented, causing drops in EDC
- Italy (Holstein) Drops in information due to data edits
- USA (All breeds) Drops in information for most traits are due to pedigree corrections and herd-year edits
- France (Holstein) Reliability from the single step is now used as a factor of the publication

Conformation

- USA (Holstein) Bulls with fewer daughters is the result of removal of incorrect daughters discovered through parentage verification
- New Zealand (Jersey) Continuous DNA parentage testing affected daughter counts, herd count, EDCs, and reliabilities
- France (Holstein) The reliability from the single step is now used as a factor of the publication. For conformation traits, before it was the reliability of udder support which was used as reference. Now it is locomotion which is used. Due to this change bulls do loose points in reliability

Udder health

- Italy (Holstein) Drops in information for some bulls due to data edits
- USA (Holstein) Drops in information for most traits are due to pedigree corrections and herd-year minimum edits
- New Zealand (Jersey) Continuous DNA parentage testing affected daughter counts, herd count, EDCs, and reliabilities
- Germany (Holstein) Changes in data caused decrease in number of daughters
- France (Holstein) Reliabilities are taken from single step model. This change can have the effect that some bulls do not meet publication rules anymore

Longevity

- Norway (RDC) Rolling definition of effects redistribute the daughters and some bulls loose EDC
- Denmark, Finland and Sweden (All breeds) Quality check editing on data causing drops in information
- Italy (Holstein) Drops in information for some bulls due to data edits
- France (Holstein) Reliabilities are taken from single step model. This change can have the effect that some bulls do not meet publication rules anymore

Milking speed and temperament

- Norway (RDC) Rolling definition of effects redistribute the daughters and some bulls loose EDC
- Italy (HOL) Applied the yearly cut-off of data and base change.
- USA (Holstein) Drops in information for most traits are due to pedigree corrections and herd-year minimum edits
- New Zealand (Jersey) Continuous DNA parentage testing affected daughter counts, herd count, EDCs, and reliabilities
- France (Holstein) Reliability from the single step is now used as a factor of the publication

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	108,4	112,2	108,6	110,1	8,8
Belgium	15	108,1	118,0	113,5	116,3	8,4
Brasil	10	120,8	112,2	113,5	111,5	7,0
Canada	392	112,1	124,5	115,2	119,5	9,8
Switzerland	22	102,8	104,3	103,0	103,5	11,6
Czech Republic	33	116,8	116,7	116,3	116,3	7,3
Germany	507	117,4	117,4	120,0	119,5	6,7
DNK/FIN/SWE	133	100,8	120,3	114,2	119,3	5,9
Spain	87	113,8	112,0	113,1	112,5	8,5
France	398	109,9	112,0	114,0	114,0	6,5
UK	39	108,8	124,6	114,4	119,6	7,1
Hungary	29	112,7	107,7	107,2	106,3	7,8
Italy	99	113,2	113,8	116,5	116,1	7,4
Netherlands	258	109,3	116,7	115,2	117,0	8,1
Poland	57	110,0	111,9	112,7	112,9	5,8
USA	1486	114,2	125,5	117,6	121,5	7,0

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	116,9	11,0	98,4	4,4	112,0	8,0
Belgium	15	108,4	7,0	106,1	5,1	109,4	8,4
Brasil	10	109,9	5,3	95,9	2,5	105,3	7,3
Canada	392	114,6	11,0	99,3	4,6	109,8	9,2
Switzerland	22	116,0	9,4	100,0	5,0	120,8	6,3
Czech Republic	33	111,6	7,6	101,0	5,2	105,8	7,3
Germany	507	108,1	8,5	103,2	4,5	110,1	7,1
DNK/FIN/SWE	133	103,1	9,2	102,1	4,8	108,4	6,8
Spain	87	112,8	10,3	104,9	4,8	113,8	8,8
France	398	116,7	8,4	104,3	4,0	116,3	7,7
UK	39	106,1	8,7	99,3	3,9	105,9	7,4
Hungary	29	114,1	8,7	97,8	4,1	106,1	6,5
Italy	99	112,2	7,8	99,5	3,9	111,6	7,5
Netherlands	258	109,2	8,0	107,3	6,3	105,4	7,7
Poland	57	113,5	8,5	102,3	3,7	107,6	8,7
USA	1486	108,4	9,5	98,0	4,3	104,8	8,2

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	98,4	5,2
Belgium	15	102,3	6,7
Brasil	10	97,0	4,0
Canada	390	99,9	4,8
Switzerland	22	101,6	5,9
Czech Republic	19	99,3	5,5
Germany	507	102,2	6,0
DNK/FIN/SWE	133	106,1	5,7
Spain	87	105,0	6,8
France	398	108,8	6,2
UK	39	100,7	4,2
Hungary	29	94,2	8,3
Italy	99	103,8	7,1
Netherlands	258	102,7	6,2
Poland	57	107,0	7,5
USA	1486	99,9	5,1

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	102,4	5,5
Belgium	15	110,6	8,7
Brasil	10	107,0	3,7
Canada	392	108,8	6,0
Switzerland	22	105,9	7,1
Czech Republic	19	108,5	4,5
Germany	507	113,9	5,8
DNK/FIN/SWE	133	112,5	6,1
Spain	87	110,6	8,0
France	398	110,5	5,7
UK	39	110,3	3,9
Hungary	29	99 ,0	7,1
Italy	99	109,3	5,4
Netherlands	258	110,6	7,0
Poland	57	107,2	6,9
USA	1486	110,5	4,9

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	98,7	5,7	21	102,9	5,1
Belgium	15	100,9	3,4	15	102,5	4,7
Brasil	10	101,0	3,9	10	103,2	4,5
Canada	384	100,4	4,8	392	105,1	4,8
Switzerland	20	98,3	4,5	22	102,3	4,8
Czech Republic	19	100,1	4,2	19	104,1	5,0
Germany	483	100,3	4,6	507	102,2	5,0
DNK/FIN/SWE	122	101,4	5,2	133	102,8	4,7
Spain	87	99,2	5,0	80	100,7	5,0
France	382	97,2	4,8	382	102,1	5,1
UK	39	103,4	3,9	39	103,8	3,7
Hungary	29	96,8	3,3	29	101,7	2,5
Italy	99	99,2	4,3	99	103,3	4,1
Netherlands	247	101,6	4,3	258	101,4	5,5
Poland	57	97,4	4,1	57	101,0	4,6
USA	1431	101,5	4,0	1486	105,7	4,4

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	6,0
Belgium	15	96,3	5,4
Brasil	10	99,4	5,1
Canada	392	98,3	6,3
Switzerland	22	102,0	8,3
Czech Republic	19	97,8	4,5
Germany	507	101,1	6,6
DNK/FIN/SWE	133	106,8	6,7
Spain	87	100,6	8,2
France	382	101,5	6,1
UK	39	102,0	5,0
Italy	99	101,4	6,3
Netherlands	258	99,7	7,2
Poland	57	100,4	8,3
USA	1486	100,6	5,8

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	100,4	2,4	20	105,3	3,1
Belgium	15	99,3	4,2	13	103,3	6,2
Brasil	10	104,5	0,8			
Canada	392	103,5	4,0	366	107,0	5,8
Switzerland	22	102,5	3,7	5	96,8	1,4
Czech Republic	19	99,4	7,1			
Germany	492	99,7	5,7	484	104,5	8,6
DNK/FIN/SWE	133	103,1	2,8	130	104,7	5,2
Spain	87	96,2	3,4	78	103,7	1,4
France	393	96,2	3,8	374	105,9	3,3
UK	38	103,9	3,2	38	106,3	6,5
Italy	98	98,7	7,9	97	105,6	6,2
Netherlands	258	99,1	5,3	253	103,9	10,5
Poland	54	94,5	22,6	35	105,2	1,4
USA	1439	104	3,3	1404	106,7	5,6

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 August 2022 the following changes are done compared to April 2022 routine evaluation:

Yield:
- No changes

Fertility:
- Netherlands: Addition of new bulls and data caused an increase of SD in heifer's ability to conceive

Calving:
- Germany: Due to the French bulls missing in the April 2022 MACE evaluation which were part of the joint EuroGenomics bulls reference population, a decrease in estimated genetic standard deviations has been observed
- Denmark, Finland, and Sweden: Change in EDC calculation, in line with MACE changes
- Nederland's: Due to the French bulls missing in the April 2022 MACE evaluation which were part of the joint EuroGenomics bulls reference population, a decrease in reliability has been observed

Conformation:
- Nederland's: Changes in overall udder score is due to a change in formula to calculate the udder composite

Udder health:
- Nederland's: Due to the French bulls missing in the April 2022 MACE evaluation which were part of the joint EuroGenomics bulls reference population, a decrease in reliability has been observed

Longevity:
- No change

Milking speed and temperament:
- Italy: Base change for milking speed, in line with MACE

Dates of publication of Interbull breeding values in 2022:

Month	Date
August	9
December	6

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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