

## **INTERBULL breeding values calculated December 2021**

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 10<sup>th</sup> August 2021

<b>Current evaluation</b>	
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.

<b>Trait:</b>	<b>International breeding values for the breeds:</b>
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](http://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 2014 or later, that have more than 60 daughters in the genetic evaluation.

Table 2. Genetic level for yield traits, Red breeds. Bulls born in 2014 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Australia	15	90,5	89,7	83,7	85,3	14,0
Canada	33	94,6	92,8	89,7	90,3	7,4
Germany	13	100,0	104,4	100,5	102,8	10,1
DNK/FIN/SWE	223	100,2	102,4	103,0	103,4	7,6
Estonia	10	99,5	91,2	93,1	90,4	6,9
UK	9	79,7	79,6	71,6	74,0	9,4
Norway	134	96,1	95,8	96,0	95,9	8,9
New Zealand	22	89,8	93,5	86,5	89,4	9,9

Table 3. Genetic level for yield traits, Holstein. Bulls born in 2014 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Australia	91	95,9	100,6	95,9	98,6	8,5
Belgium	27	106,1	106,7	105,7	106,1	7,2
Canada	531	109,0	108,6	106,2	106,8	9,4
Switzerland	93	96,6	99,7	96,4	98,2	8,7
Czech Republic	40	108,2	107,1	103,8	104,5	8,1
Germany	860	110,2	106,3	108,0	106,6	9,3
DNK/FIN/SWE	336	102,8	104,4	105,4	105,5	9,6
Spain	99	108,5	102,4	101,3	100,1	8,4
Estonia	20	101,9	95,9	96,2	94,5	5,2
France	392	104,4	102,3	103,9	102,9	8,7
UK	95	104,2	108,7	104,1	106,6	9,0
Ireland	109	75,3	89,3	82,2	87,9	9,1
Israel	136	100,8	104,5	100,7	102,8	7,1
Italy	384	105,6	103,7	103,5	103,1	8,0
Japan	60	108,6	106,9	105,1	105,2	7,9
Luxembourg	9	112,7	109,9	111,0	109,9	4,8
Netherlands	678	105,6	105,2	105,5	105,3	9,0
New Zealand	903	77,8	92,8	87,6	92,9	6,7
Poland	94	101,7	101,0	99,5	99,8	9,0
Slovenia	35	96,1	90,7	89,9	88,9	5,9
USA	2969	109,3	110,0	106,8	108,0	9,1

Table 4. Genetic level for yield traits, Jersey. Bulls born in 2014 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Australia	35	104,7	91,9	98,7	92,5	7,6
Canada	21	108,8	93,6	100,4	93,5	17,1
DNK/FIN/SWE	96	102,9	105,3	105,9	106,4	8,5
New Zealand	417	98,5	92,4	98,1	94,3	8,0
USA	451	116,9	100,2	110,4	101,8	10,1

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 2014 or later.

Country	No. of bulls	Frame		Feet&legs		Udder	
		Average	STD	Average	STD	Average	STD
Canada	42	101,2	8,1	102,8	4,1	102,9	8,5
Germany	17	107,6	8,4	105,7	4,3	103,6	10,3
DNK/FIN/SWE	221	98,9	11,2	100,8	5,2	100,6	8,6
UK	8	106,4	8,7			104,8	4,1
Norway	67	102,9	11,8	98,2	5,5	83,6	8,4

Table 6. Genetic level of conformation traits, Holstein. Bulls born in 2014 or later.

Country	No	Frame		Feet&legs		Udder	
		Average	STD	Average	STD	Average	STD
Australia	28	110,1	9,7	98,1	4,2	98,9	12,7
Belgium	25	112,8	14,4	104,1	5,7	105,0	8,9
Canada	413	117,2	10,6	99,2	6,1	112,6	9,4
Switzerland	124	112,4	9,5	99,2	5,1	107,4	9,6
Czech Republic	42	113,7	9,1	99,6	6,2	102,3	10,6
Germany	855	110,2	9,2	101,7	6,2	106,3	9,0
DNK/FIN/SWE	326	101,6	11,2	101,1	6,2	102,7	8,9
Spain	101	117,6	8,8	101,6	5,6	106,7	7,6
Estonia	20	108,6	7,8	98,3	5,0	88,7	10,0
France	338	116,3	10,3	102,2	6,0	108,7	8,7
UK	74	111,6	9,6	100,6	3,9	105,5	8,7
Ireland	46	89,0	10,9	96,1	4,5	76,3	12,8
Italy	381	113,9	10,2	100,6	5,7	105,9	8,8
Japan	408	114,2	9,6	100,0	5,5	103,5	8,8
Korea	20	109,4	7,4	99,9	3,6	100,4	5,5
Luxembourg	10	108,9	10,7	104,7	5,2	106,0	4,8
Netherlands	547	110,1	9,8	103,6	6,5	103,7	9,6
New Zealand	873	84,4	9,2				
Poland	81	112,1	7,6	99,4	4,8	96,4	6,9
Slovenia	35	104,0	10,2	98,8	5,7	92,4	8,8
USA	1639	111,7	10,6	98,6	5,8	108,8	8,8

Table 7. Genetic level of conformation traits, Jersey. Bulls born in 2014 or later.

Country	No	Frame		Feet&legs		Udder	
		Average	STD	Average	STD	Average	STD
Australia	11	108,8	7,3	100,9	8,1	90,8	8,0
Canada	30	110,7	8,9	104,7	6,9	98,7	9,8
DNK/FIN/SWE	99	100,0	9,0	99,5	7,4	100,7	9,1
USA	419	112,5	9,0	103,4	7,1	98,2	8,5

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

- Red breeds: Canada have generally higher genetic level for udder than DNK/FIN/SWE. Compared to Norway, DNK/FIN/SWE have similar genetic level for feet&legs and higher level for udder
- Holstein: DNK/FIN/SWE has 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 2014 or later.

Country	No. of bulls	Average	STD
Australia	21	97,2	7,4
Canada	15	98,1	8,3
DNK/FIN/SWE	265	100,2	8,3
Estonia	9	95,1	10,7
UK	5	98,2	7,3
Norway	136	98,7	10,0
New Zealand	46	94,4	7,7

Table 9. Genetic level for udder health, Holstein. Bulls born in 2014 or later.

Country	No. of bulls	Average	STD
Australia	117	95,2	7,7
Belgium	22	96,2	8,3
Canada	262	97,9	8,4
Switzerland	25	95,0	7,1
Czech Republic	42	96,8	8,6
Germany	586	98,5	7,7
DNK/FIN/SWE	316	102,2	7,9
Spain	108	96,4	8,3
Estonia	22	91,5	8,5
France	337	98,8	8,1
UK	59	98,2	6,7
Ireland	109	94,2	8,9
Israel	140	99,6	9,3
Italy	356	97,0	8,8
Japan	345	91,8	8,5
Korea	33	94,1	6,0
Luxembourg	9	102,1	7,6
Netherlands	382	99,6	8,2
New Zealand	931	92,3	7,0
Poland	104	95,9	9,5
Slovenia	36	94,1	7,8
USA	1585	97,2	8,8

Table 10. Genetic level for udder health, Jersey. Bulls born in 2014 or later.

Country	No. of bulls	Average	STD
Australia	47	91,9	6,8
Canada	9	85,6	15,2
DNK/FIN/SWE	106	101,2	8,7
New Zealand	473	95,0	6,6
USA	245	86,6	7,9

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

- Red breeds: DNK/FIN/SWE has higher genetic level than Norway
- Holstein: DNK/FIN/SWE have 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 2013 or later.

Country	No. of bulls	Average	STD
Australia	12	86,4	11,5
Canada	56	91,8	8,5
Germany	23	94,8	7,9
DNK/FIN/SWE	261	101,7	8,4
UK	8	83,0	9,7
Norge	219	89,9	8,2
New Zealand	8	82,5	5,3
USA	7	76,7	13,5

Table 12. Genetic level for longevity, Holstein. Bulls born in 2013 or later.

Country	No. of bulls	Average	STD
Australia	97	89,0	8,5
Austria	7	89,4	6,9
Belgium	38	99,3	8,3
Canada	678	100,9	9,0
Switzerland	152	90,9	8,3
Czech Republic	52	102,9	7,9
Germany	1189	101,0	9,2
DNK/FIN/SWE	451	101,5	8,5
Spain	151	97,2	7,2
France	466	94,9	8,3
UK	146	99,0	8,4
Hungary	8	96,7	9,1
Ireland	170	89,5	5,5
Israel	181	91,8	6,3
Italy	350	99,7	7,0
Luxembourg	14	104,2	10,4
Netherlands	983	100,1	9,1
New Zealand	482	84,8	5,5
Poland	179	94,2	8,9
Slovenia	51	92,0	8,3
USA	3414	104,1	8,7

Table 13. Genetic level for longevity, Jersey. Bulls born in 2013 or later.

Country	No. of bulls	Average	STD
Australia	33	92,4	6,5
Canada	20	88,3	8,3
DNK/FIN/SWE	95	99,5	7,8
UK	5	89,2	5,4
New Zealand	153	90,8	4,8
USA	642	96,7	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: France has the lowest level, while USA and DNK/FIN/SWE have the highest level
- Jersey: Denmark has higher genetic level than other populations

## Calving – maternal and direct

For Red breeds Canada, Denmark, Finland, Norway, Sweden and the United States send data to this evaluation. It has not been possible to obtain 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 2014 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 2014 or later.

Country	Calving, direct			Calving, maternal		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Canada	43	95,0	6,8	26	97,4	6,7
DNK/FIN/SWE	222	101,0	7,1	218	100,6	6,3
Norway	135	100,0	7,2	135	90,5	7,2



Table 15. Genetic level for calving, maternal and calving, direct, Holstein. Bulls born in 2014 or later.

Country	Calving, direct			Calving, maternal		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	120	96,0	6,0	1	99,0	
Austria	5	93,4	7,1	3	104,3	10,8
Belgium	28	98,7	5,7	23	100,2	7,8
Canada	562	96,7	5,9	446	101,6	6,9
Switzerland	129	95,7	5,5	96	94,8	9,7
Germany	919	97,1	6,4	813	99,3	7,9
DNK/FIN/SWE	343	100,3	6,7	339	101,9	7,9
Spain	101	95,1	4,4	58	99,8	4,5
France	414	96,4	6,9	369	102,4	8,7
UK	95	98,7	5,3	33	100,3	5,5
Ireland	50	100,0	3,9	0		
Israel	54	97,5	6,0	147	93,3	6,2
Italy	378	95,2	6,2	164	100,4	5,8
Luxembourg	11	97,0	4,7	9	102,2	5,1
Netherlands	652	97,5	6,5	532	97,9	8,9
New Zealand	937	99,8	4,8	0		
USA	3122	98,4	5,7	2172	102,4	6,2

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 2014 or later.

Country	No. of bulls	Average	STD
Australia	12	95,8	15,4
Canada	33	98,4	9,6
Germany	13	91,2	9,4
DNK/FIN/SWE	211	100,4	9,0
UK	9	93,7	7,6
Norway	120	113,5	8,2
New Zealand	18	99,9	7,1

Table 17. Genetic level for female fertility, Holstein. Bulls born in 2014 or later.

Country	No. of bulls	Average	STD
Australia	82	90,1	9,3
Belgium	25	94,5	6,6
Canada	515	96,2	8,9
Switzerland	90	94,5	4,1
Czech Republic	36	96,1	2,4
Germany	763	93,8	8,7
DNK/FIN/SWE	343	101,6	11,0
Spain	57	93,4	7,5
France	341	94,8	8,5
UK	75	100,0	7,7
Ireland	109	107,0	3,4
Israel	130	96,5	2,4
Italy	367	94,1	8,1
Japan	60	90,6	6,6
Luxembourg	8	99,1	3,6
Netherlands	609	94,8	8,9
New Zealand	490	97,8	5,6
Poland	53	91,3	5,7
USA	2841	97,3	9,3

Table 18. Genetic level for female fertility, Jersey. Bulls born in 2014 or later.

Country	No. of bulls	Average	STD
Australia	30	90,3	7,9
Canada	20	85,5	11,4
DNK/FIN/SWE	119	99,7	12,7
New Zealand	229	95,5	8,1
USA	431	83,2	11,1

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 has 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 2014 or later are shown for Holstein, Red breeds, and Jersey.

Table 19. Genetic level for milking speed and temperament, Red breeds. Bulls born in 2014 or later.

Country	Milking speed			Temperament		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	10	99,5	5,8	10	106,1	7,8
Canada	42	91,6	14,9	41	94,9	14,9
Germany	7	99,6	3,9	16	99,8	4,6
DNK/FIN/SWE	237	99,5	7,7	212	100,5	11,1
Norway	121	93,9	6,3	103	99,0	8,6
New Zealand	11	98,1	6,5	11	99,0	6,0

Table 20. Genetic level for milking speed and temperament, Holstein. Bulls born in 2014 or later.

Country	Milking speed			Temperament		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	70	102,7	3,8	70	102,2	4,6
Austria	5	99,4	9,9			
Belgium	19	97,2	14,5	21	101,3	13,0
Canada	339	98,9	10,6	331	103,6	9,8
Switzerland	127	94,9	9,2	127	99,7	9,3
Germany	660	99,0	9,2	563	102,5	14,0
DNK/FIN/SWE	328	99,7	7,5	269	101,6	16,1
France	293	98,1	8,3	290	103,1	9,4
UK	79	100,5	12,9	77	104,2	9,7
Italy	325	99,6	4,6	325	103,1	8,9
Luxembourg	9	94,9	13,5			
Netherlands	430	95,5	12,2	419	102,5	11,7
New Zealand	906	103,0	4,1	906	96,4	2,9
Slovenia	37	95,3	5,5			
USA	711	101,2	11,6	690	104,8	11,0

Table 21. Genetic level for milking speed, Jersey. Bulls born in 2014 or later.

Country	No. of bulls	Average	STD
Australien	24	97,4	9,6
Canada	23	94,0	8,6
DNK/FIN/SWE	105	100,2	10,9
New Zealand	417	98,6	6,3
USA	33	97,6	9,3

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 higher than USA

## NTM for Nordic and foreign bulls

NTM index is calculated for all bulls (Nordic and others) that have official breeding values (NAV breeding values or international EBVs) for yield, udder health and conformation.

Interbull NTM is calculated by weighing the Interbull / NAV breeding values for yield, female fertility, calving (maternal and direct), udder health, longevity, feet&legs, udder, milking speed, and temperament. The same economic weight factors are used as for NAV breeding values.

Rules for calculation of NTM based partly or entirely on international breeding values are stated below in order of priority.

### 1. Bull has NAV breeding value for a trait

If the bull has NAV breeding value for a specific trait, this is used in the calculation of NTM - no matter if the bull also has international breeding value for that trait.

### 2. Bull has no NAV breeding value, but has an international breeding value for a trait

If the bull does not have NAV breeding value for the trait, the international breeding value is used, provided that Interbull calculates international breeding values for that trait and the bull comes from a country which provides data for that trait.

### 3. Bull has no NAV or no international breeding value for a trait

For traits where no Interbull EBV is available or the bull has no Interbull EBV, and at the same time it is not tested in the Nordic countries, a pedigree index is used. Pedigree index is calculated as  $\frac{1}{2} (EBV_{\text{sire}} - 100) + \frac{1}{4} (EBV_{\text{maternal grand sire}} - 100) + 100$ . The contributions from the sire and maternal grand sire can be based on either NAV breeding values or international breeding values. If  $EBV_{\text{sire}}$  or  $EBV_{\text{maternal grand sire}}$  are unofficial the pedigree index is set to 100.

## Publication rules for NTM

All foreign and Nordic bulls that have Interbull breeding values for yield, udder health and udder get a public Interbull NTM. This NTM is calculated with a lower reliability than an NTM for Nordic proven bulls, where information for all traits is always available.

## Genetic level for Interbull NTM

In tables 22-24 genetic level for Interbull NTM for Jersey, Red breeds and Holstein are shown. Bulls included are born in 2014 or later.

Table 22. Genetic level for NTM, Red breeds. Bulls born in 2014 or later.

Country	No. of bulls	Average	STD
Canada	23	-14,2	6,7
DNK/FIN/SWE	222	5,8	8,8
Norway	67	-1,9	8,9

Table 23. Genetic level for NTM, Holstein. Bulls born in 2014 or later.

Country	No. of bulls	Average	STD
Australia	31	-6,3	10,9
Belgium	25	3,6	6,9
Canada	296	3,7	10,6
Switzerland	68	-6,7	9,7
Czech Republic	40	1,6	7,8
Germany	608	3,8	8,6
DNK/FIN/SWE	326	8,5	9,0
Spain	96	-4,3	9,5
Estonia	20	-12,7	5,8
France	320	-0,1	9,2
UK	69	5,6	7,9
Ireland	51	-13,6	8,3
Italy	356	-1,0	8,6
Japan	60	-1,3	9,6
Luxembourg	8	10,8	4,2
Netherlands	466	3,5	9,3
Poland	90	-6,9	10,3
Slovenia	35	-17,9	7,6
USA	1427	6,8	8,8

Table 24. Genetic level for NTM, Jersey. Bulls born in 2014 or later.

Country	No. of bulls	Average	STD
Australia	5	-12,2	8,2
Canada	7	-12,9	7,9
DNK/FIN/SWE	95	7,1	7,5
USA	185	-8,6	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 2021 the following changes are done compared to August 2021 evaluation. Only changes in major countries:

#### Yield

- Holstein in France has some drops in information due to corrections made in pedigree
- Jersey in New Zealand has continuous DNA parentage testing so daughters will always change. Further change in estimation of reliability, editing and effects in model

### Fertility

- Holstein in France has some drops in information due to corrections made in pedigree
- Holstein from Germany has deleted uninformative herd-years and included extra validation of records
- Holstein from USA has drops in information due to pedigree corrections and herd-year minimum edits
- Jersey in New Zealand has continuous DNA parentage testing so daughters will always change. Fixed bug in EDC calculations. Further new model, improved data quality
- All breeds in DFS have included inbreeding in the model

### Calving

- Holstein in France has some drops in information due to corrections made in pedigree
- Holstein in Germany has smaller decreases in herds, daughters or EDC caused by data editing or pedigree correction
- Holstein from USA has drops in information due to pedigree corrections and herd-year minimum edits
- Jersey in New Zealand has continuous DNA parentage testing so daughters will always change. Fixed bug in EDC calculations

### Conformation

- RDC from Norway has implementing new models and data extraction pipeline for most traits
- Holstein in France has some drops in information due to corrections made in pedigree
- Holstein from USA has decrease in information due to genomic testing and parentage checks
- Jersey in New Zealand has continuous DNA parentage testing so daughters will always change. Fixed bug in EDC calculations. Use new software

### Udder health

- Holstein in France has some drops in information due to corrections made in pedigree
- Jersey in New Zealand has continuous DNA parentage testing so daughters will always change. Use new software. Updated heritability

### Longevity

- Holstein in France has some drops in information due to corrections made in pedigree
- Jersey in New Zealand has continuous DNA parentage testing so daughters will always change. Further change in editing and new model

### Milking speed and temperament

- Holstein in France has some drops in information due to corrections made in pedigree
- Jersey in New Zealand has continuous DNA parentage testing so daughters will always change. Fixed bug in EDC calculations

## 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 2018 or later.

Country	No. of bulls	Milkindex	Fatindex	Proteinindex	Y-index	Y-index STD
Australia	17	107,8	112,1	109,2	110,6	8,7
Belgium	27	106,4	111,0	110,3	111,4	9,1
Brasil	13	120,1	111,4	114,9	112,3	5,1
Canada	503	110,7	121,7	113,8	117,6	9,6
Switzerland	24	104,1	106,5	104,8	105,6	8,8
Czech Republic	38	116,1	115,7	116,1	116,0	5,6
Germany	653	116,9	116,4	119,1	118,4	6,2
DNK/FIN/SWE	230	103,9	114,6	112,0	114,7	7,7
Spain	97	114,6	111,5	112,9	112,0	6,9
France	464	110,3	111,3	113,5	113,2	6,2
UK	54	107,1	122,1	111,9	117,0	14,6
Hungary	59	110,6	108,5	106,2	106,3	9,1
Italy	114	113,3	113,6	116,0	115,6	6,0
Netherlands	294	109,3	116,1	115,1	116,7	7,2
Poland	85	110,9	110,0	112,1	111,5	6,1
USA	1718	112,9	123,7	115,8	119,5	6,7

International comparison for yield shows that DNK/FIN/SWE, has a little lower genetic level than 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 2018 or later.

Country	No	Frame		Feet&legs		Udder	
		Average	STD	Average	STD	Average	STD
Australia	17	114,9	13,9	99,6	3,6	114,8	9,5
Belgium	16	107,9	8,2	105,6	4,7	108,4	4,9
Brasil	13	107,3	6,6	95,2	3,9	105,6	6,0
Canada	503	113,7	11,3	99,5	4,4	111,3	9,5
Switzerland	24	115,6	8,6	100,8	4,9	117,5	8,4
Czech Republic	38	111,7	6,9	100,2	4,8	103,5	6,2
Germany	653	109,0	8,5	103,4	4,5	110,7	7,1
DNK/FIN/SWE	230	103,3	9,0	101,4	5,0	107,9	7,4
Spain	97	113,5	10,2	103,7	5,4	114,4	9,2
France	464	117,6	8,2	104,2	4,4	116,1	7,8
UK	54	103,2	11,7	99,7	4,5	103,2	12,0
Hungary	59	112,3	8,7	98,9	4,9	105,2	6,7
Italy	114	112,1	8,0	100,2	4,4	110,7	7,7
Netherlands	294	108,5	8,0	107,2	5,5	105,7	8,1
Poland	85	115,4	9,5	102,4	4,1	109,0	7,5
USA	1718	106,5	9,7	98,3	4,4	105,1	8,6

International comparison for conformation traits among most important populations shows that DNK/FIN/SWE has lower genetic level for frame than most other populations. For feet&legs and udder there are only small differences between populations.

### Somatic cell count and udder health

In tables 27 is a comparison of genetic level of udder health for bulls from different countries.

Table 27. Genetic level for udder health, Holstein. Bulls born in 2018 or later.

Country	No. of bulls	Average	STD
Australia	17	98,7	5,0
Belgium	16	101,7	7,1
Brasil	13	98,1	3,2
Canada	503	99,4	4,9
Switzerland	21	98,8	5,8
Czech Republic	20	98,9	6,6
Germany	651	101,7	6,1
DNK/FIN/SWE	230	105,0	6,2
Spain	97	103,8	7,7
France	458	107,8	6,3
UK	54	99,3	4,8
Hungary	42	95,3	6,4
Italy	114	101,8	6,0
Netherlands	294	102,2	6,1
Poland	85	102,9	6,9
USA	1718	98,7	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 2018 or later.

Country	No. of bulls	Average	STD
Australia	17	102,7	6,3
Belgium	16	108,7	5,5
Brasil	13	106,5	4,5
Canada	503	108,1	5,8
Switzerland	24	105,5	6,6
Czech Republic	20	108,2	6,4
Germany	653	112,7	5,8
DNK/FIN/SWE	230	111,7	6,3
Spain	97	109,3	7,7
France	464	108,9	5,8
UK	54	108,0	7,1
Hungary	59	99,8	6,5
Italy	114	107,9	5,9
Netherlands	294	110,5	6,5
Poland	85	104,3	6,4
USA	1718	109,1	5,0

International comparison for longevity among most important populations shows that DNK/FIN/SWE are among the populations with 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, Holstein. Bulls born in 2018 or later.

Country	Calving, direct			Calving, maternal		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	17	98,1	6,0	17	101,4	4,9
Belgium	23	98,4	4,7	16	103,3	5,5
Brasil	13	101,5	3,2	13	104,4	3,5
Canada	472	100,1	4,8	503	106,0	4,6
Switzerland	18	99,7	4,7	24	101,7	5,5
Czech Republic	20	102,1	4,7	20	103,9	3,7
Germany	579	100,5	4,6	653	102,3	5,8
DNK/FIN/SWE	203	101,1	5,0	230	103,5	4,8
Spain	97	97,9	5,4	85	101,3	4,9
France	464	97,1	4,7	463	102,5	5,3
UK	54	103,2	4,3	53	103,9	5,7
Hungary	59	96,9	3,5	59	101,0	3,7
Italy	114	99,5	4,7	114	103,3	4,5
Netherlands	256	101,8	4,5	294	102,1	5,9
Poland	85	95,8	3,9	85	100,3	5,9
USA	1445	101,1	4,2	1718	106,0	4,3

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 2018 or later.

Country	No. of bulls	Average	STD
Australia	17	98,8	6,4
Belgium	27	97,0	5,2
Brasil	13	101,0	4,4
Canada	503	99,8	6,8
Switzerland	24	102,4	9,1
Czech Republic	20	97,8	5,5
Germany	652	101,1	6,8
DNK/FIN/SWE	230	107,1	7,1
Spain	97	100,2	7,7
France	464	99,9	6,3
UK	54	102,3	6,8
Hungary	12	94,8	3,6
Italy	114	100,3	6,2
Netherlands	294	99,2	6,3
Poland	85	97,1	7,6
USA	1718	100,5	5,9

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 2018 or later.

Country	Milking speed			Temperament		
	No. of bulls	Average	STD	No. of bulls	Average	STD
Australia	17	100,3	2,0	15	102,9	2,0
Belgium	16	97,6	3,0	15	105,5	4,6
Brasil	13	99,1	1,2			
Canada	501	100,4	4,0	457	103,9	5,2
Switzerland	22	98,8	2,9			
Czech Republic	18	99,7	3,4			
Germany	637	98,2	4,9	632	104,9	8,0
DNK/FIN/SWE	229	101,5	3,8	227	105,1	4,2
Spain	97	96,2	3,7	85	104,7	4,4
France	456	94,8	3,6	442	105,1	4,2
UK	54	101,7	4,2	53	103,6	4,7
Hungary	12	97,7	1,9	12	104	2,3
Italy	112	96,7	6,1	103	103,1	5,6
Netherlands	293	96,9	5,3	290	104,4	9,8
Poland	82	96,9	17,3	59	105,2	7,6
USA	1697	102,1	3,2	1670	104,1	5,2

For milking speed DNK/FIN/SWE are among the best populations. For temperament there are only small differences between populations.

### Changes since last routine run

In the routine evaluation in August 2021 the following changes are done compared to April 2021 routine evaluation:

#### Yield:

- No change

#### Fertility:

- DFS has submitted new GEBV in line with MACE proofs

#### Calving:

- No changes

#### Conformation:

- Canada has started to calculate composites instead of evaluated directly in line with the changes applied in MACE for some traits

#### Udder health:

- No change

#### Longevity:

- No change

#### Milking speed and temperament:

- No change

**Dates of publication of Interbull breeding values in 2022:**

Month	Date
April	5
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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