

## **INTERBULL breeding values calculated April 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 4<sup>th</sup> April 2023

<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 <b>temperament</b>  NTM for Nordic and foreign <b>bulls</b>	Young genomic tested bulls - HOL:  Yield Conformation Somatic cell count and udder health Longevity Calving – maternal and direct Female fertility  Milking speed and <b>temperament</b>

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 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	5	86,6	83,8	78,8	79,6	14,8
Canada	23	94,0	91,7	88,6	89,1	8,4
Germany	5	103,0	108,6	103,2	106,2	4,4
DNK/FIN/SWE	150	99,7	104,0	103,1	104,5	7,5
UK	5	79,0	82,2	71,2	75,4	11,7
Norway	103	96,6	94,6	95,0	94,5	9,2
New Zealand	13	89,4	93,3	85,8	89,0	6,9
USA	5	79,4	74,8	71,4	71,2	18,0

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	36	99,5	104,0	101,1	103,1	10,9
Belgium	11	103,1	104,3	103,9	104,3	7,8
Canada	339	110,3	110,8	109,3	109,9	10,9
Switzerland	64	98,4	99,6	98,2	99,0	8,5
Czech Republic	25	109,0	108,4	106,2	106,7	9,0
Germany	585	110,4	107,1	109,1	107,7	9,6
DNK/FIN/SWE	204	102,2	104,7	105,4	105,9	9,4
Spain	47	113,0	105,8	105,5	103,8	6,5
Estonia	5	91,0	93,0	88,4	90,4	9,8
France	234	104,5	102,8	105,1	104	8,2
UK	37	101,7	110,1	103,1	107,4	9,2
Israel	93	101,2	102,8	100,3	101,5	7,4
Italy	165	108,1	106,6	107,7	107,0	8,7
Japan	23	112,4	110,3	109,0	108,9	6,3
Luxembourg	11	119,0	110,2	114,4	111,1	6,2
Netherlands	442	105,6	107,5	106,8	107,5	9,5
New Zealand	608	75,7	93,2	86,3	92,8	6,5
Poland	89	107,1	105,3	105,3	104,8	7,3
Slovenia	26	99,7	92,5	93,9	91,8	6,0
USA	1974	109,8	112,6	108,7	110,6	9,7

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	16	104,1	91,1	97,5	91,4	7,5
Canada	18	111,3	95,7	102,9	95,7	13,5
DNK/FIN/SWE	63	103,2	107,4	107,1	108,6	8,4
New Zealand	288	97,6	94,8	98,0	96,1	7,4
USA	320	115,9	100,6	110,0	102,2	11,1

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 2016 or later.

Country	No. of bulls	Frame		Feet&legs		Udder	
		Average	STD	Average	STD	Average	STD
Canada	30	102,6	9,4	103,2	4,4	102,2	8,9
Germany	8	105,6	10,4	106,8	4,8	104,5	5,5
DNK/FIN/SWE	146	98,7	11,2	100,6	5,0	102,0	7,5
UK	6	102,8	4,3			101,7	5,2
Norway	83	102,3	12,9	98,9	5,4	84,3	9,1
USA	5	113,0	7,0	105,4	3,8	111,8	7,5

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	9	119,0	8,9	97,0	3,2	104,7	12,4
Belgium	9	106,9	15,6	107,3	6,5	102,8	7,3
Canada	274	115,8	11,1	97,3	6,3	112,9	9,5
Switzerland	81	111,9	8,4	98,9	5,2	108,8	9,0
Czech Republic	28	111,3	10,4	98,9	3,8	105,6	9,1
Germany	568	109,7	9,4	102,1	6,3	107,8	8,0
DNK/FIN/SWE	191	101,7	11,0	101,1	6,3	104,3	8,6
Spain	47	117,5	8,3	101,7	6,5	107,4	8,1
Estonia	7	107,3	8,5	99,0	4,8	93,0	7,8
France	210	116,1	10,0	102,7	5,2	109,5	7,9
UK	27	104,5	9,9	99,7	4,2	104,0	7,5
Italy	158	114,6	10,4	100,6	5,3	107,1	9,6
Japan	240	113,3	9,6	98,6	5,5	103,2	8,7
Luxembourg	9	112,6	9,1	102,7	3,5	104,4	7,4
Netherlands	349	109,6	9,8	105,1	7,1	103,9	9,1
New Zealand	605	83,5	8,7				
Poland	65	112,6	8,6	101,2	6,2	99,8	7,3
Slovenia	23	107,6	11,8	98,7	6,5	94,4	6,3
USA	1162	109,4	11,0	97,9	5,8	107,6	9,3

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	7	108,6	6,1	102,6	6,4	89,3	3,0
Canada	22	110,6	8,5	105,5	7,9	100,8	9,5
DNK/FIN/SWE	62	101,4	8,2	100,3	7,5	101,0	9,6
USA	254	112,3	8,0	104,0	6,9	100,8	9,1

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 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	12	100,3	7,8
Canada	11	98,2	5,8
DNK/FIN/SWE	172	100,6	8,8
Norway	103	100,8	9,9
New Zealand	22	92,0	7,0
USA	6	99,9	9,5

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

Country	No. of bulls	Average	STD
Australia	53	94,2	7,2
Belgium	10	98,6	8,5
Canada	175	98,2	8,5
Switzerland	14	99,8	7,0
Czech Republic	29	95,9	7,4
Germany	379	100,1	6,9
DNK/FIN/SWE	196	103,9	6,9
Spain	53	97,3	7,7
Estonia	7	94,9	8,8
France	200	100,5	6,8
UK	26	99,2	6,8
Israel	93	99,4	7,8
Italy	151	99,0	8,0
Japan	190	91,8	7,5
Korea	17	90,6	5,9
Luxembourg	8	102,1	6,3
Netherlands	255	99,8	7,5
New Zealand	613	92,2	6,9
Poland	103	98,4	8,2
Slovenia	28	95,8	8,7
USA	1092	97,6	8,9

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

Country	No. of bulls	Average	STD
Australia	20	92,9	5,2
Canada	8	80,5	15,4
DNK/FIN/SWE	63	102,8	8,1
New Zealand	306	94,0	6,2
USA	155	87,6	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 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 2015 or later.

Country	No. of bulls	Average	STD
Australia	5	89,6	17,9
Canada	38	90,7	9,5
Germany	11	97,0	8,0
DNK/FIN/SWE	145	101,5	8,4
UK	8	81,9	5,4
Norge	105	91,8	7,5
USA	6	77,0	4,2

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

Country	No. of bulls	Average	STD
Australia	59	90,2	9,1
Austria	7	99,7	5,8
Belgium	19	99,9	7,8
Canada	456	101,4	8,8
Switzerland	104	93,3	8,1
Czech Republic	44	104,6	6,5
Germany	815	103,4	8,4
DNK/FIN/SWE	233	103,1	8,0
Spain	35	96,6	7,1
France	302	95,6	7,9
UK	57	100,5	10,6
Ireland	57	89,2	5,8
Israel	140	92,8	6,2
Italy	245	98,2	6,3
Luxembourg	14	106,0	9,1
Netherlands	577	102,8	9,0
New Zealand	575	86,8	5,2
Poland	152	99,0	8,2
Slovenia	43	93,7	5,4
USA	2525	103,8	8,8

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

Country	No. of bulls	Average	STD
Australia	20	93,1	7,4
Canada	20	93,6	5,7
DNK/FIN/SWE	46	98,8	6,2
New Zealand	146	89,0	4,3
USA	435	98,3	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 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	29	94,7	6,9	15	96,1	6,9
DNK/FIN/SWE	156	100,9	7,0	135	100,9	6,3
Norway	101	100,3	8,6	103	92,0	7,2

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	53	98,5	5,6	2	97,5	0,7
Austria	5	94,6	7,8	4	92,8	11,6
Belgium	14	98,2	4,2	13	99,8	8,1
Canada	368	98,2	5,5	285	102,5	5,0
Switzerland	91	96,9	5,4	66	99,1	8,1
Germany	625	98,3	5,9	574	100,1	6,9
DNK/FIN/SWE	205	100,8	6,8	199	102,3	7,0
Spain	17	97,8	4,4	12	99,8	4,5
France	266	97,4	6,1	233	104,1	8,8
UK	35	99,7	4,1	16	100,8	7,4
Israel	42	97,0	4,6	103	91,6	5,4
Italy	162	97,7	4,6	96	100,1	5,2
Luxembourg	13	96,7	4,0	11	102,0	6,9
Netherlands	423	99,2	5,9	366	98,9	7,8
New Zealand	432	101,5	4,2	0		
USA	2110	100,3	5,3	1501	102,8	5,1



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	5	97,0	12,3
Canada	22	96,3	8,6
Germany	5	87,0	12,6
DNK/FIN/SWE	137	99,7	10,2
UK	5	96,6	5,9
Norway	79	115,3	7,6
New Zealand	13	97,6	6,2

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

Country	No. of bulls	Average	STD
Australia	30	95,6	7,7
Belgium	10	95,7	7,1
Canada	319	96,4	9,0
Switzerland	62	96,0	2,6
Czech Republic	23	98,0	3,1
Germany	509	95,9	8,9
DNK/FIN/SWE	203	102,4	11,3
Spain	12	94,3	4,6
France	194	97,9	7,9
UK	28	101,5	6,1
Israel	90	96,8	2,5
Italy	141	95,5	7,0
Japan	23	91,5	6,1
Luxembourg	11	98,3	5,8
Netherlands	393	95,8	8,2
New Zealand	420	99,3	5,2
Poland	44	94,3	6
USA	1892	97,3	9,1

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

Country	No. of bulls	Average	STD
Australia	13	89,3	5,8
Canada	15	83,0	11,6
DNK/FIN/SWE	79	100,2	13,1
New Zealand	190	97,2	7,0
USA	308	86,6	9,7

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	5	94,2	4,6	5	100,0	8,0
Canada	29	91,4	15,0	27	94,9	13,5
Germany	6	104,1	5,6	8	104,5	4,7
DNK/FIN/SWE	167	98,4	8,5	137	100,6	12,0
Norway	94	93,9	4,2	89	98,5	5,6

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	26	100,6	6,6	26	102,9	7,1
Austria	5	99,6	5,9			
Belgium	8	96,5	6,1	8	98,3	7,1
Canada	212	97,2	11,2	207	104,2	9,7
Switzerland	86	95,2	8,8	87	101,0	8,7
Germany	446	97,6	9,2	366	102,1	13,2
DNK/FIN/SWE	194	99,5	7,7	153	100,8	15,8
France	216	95,7	11,0	214	103,7	11,2
UK	28	99,9	6,6	28	104,2	5,7
Italy	29	96,3	6,6	28	104,4	12,3
Luxembourg	8	92,3	8,5	269	102,7	11,5
Netherlands	309	95,0	11,0	612	97,1	2,7
New Zealand	612	103,5	3,0	502	104,6	10,0
Slovenia	29	96,1	6,5			
USA	531	100,8	12,3	26	102,9	7,1

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

Country	No. of bulls	Average	STD
Australien	12	104,4	5,3
Canada	16	98,7	11,7
DNK/FIN/SWE	62	100,2	9,6
New Zealand	280	98,6	6,7
USA	16	100,5	9,2

International comparison for milking speed and temperament among most important countries show that:

- Red breeds: DNK/FIN/SWE has a higher genetic level for milking speed 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  $\frac{1}{2} (EBV_{\text{sire}} - 100) + \frac{1}{4} (EBV_{\text{maternal grand sire}} - 100) + 100$ . 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 2016 or later.

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

Country	No. of bulls	Average	STD
Canada	11	-18,8	9,2
DNK/FIN/SWE	144	8,3	9,4
Norway	85	-5,9	9,7

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

Country	No. of bulls	Average	STD
Australia	7	3,3	12,4
Belgium	9	4,7	7,4
Canada	198	7,0	11,6
Switzerland	51	-4,3	9,5
Czech Republic	25	5,5	8,0
Germany	414	7,0	9,3
DNK/FIN/SWE	198	10,6	8,1
Spain	46	1,5	6,7
Estonia	5	-16,6	13,2
France	202	3,5	8,5
UK	25	8,7	7,6
Italy	151	4,1	8,5
Japan	23	2,4	7,2
Luxembourg	8	9,8	6,0
Netherlands	285	6,9	9,9
Poland	82	0,9	7,1
Slovenia	26	-14,0	6,4
USA	988	9,4	9,9

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

Country	No. of bulls	Average	STD
DNK/FIN/SWE	61	10,7	7,6
USA	31	-5,8	6,6

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 April 2023 the following changes are done compared to December 2022 evaluation. Only changes in major countries:

### Yield

- France, Canada, and Germany (HOL) have changed base
- New Zealand (all) have changed pedigree extract and changed base
- Italy (HOL) have cut-off of one year of data causing drops in information and changed base
- USA (HOL) have drops in information are due to pedigree corrections and herd-year minimum edits
- Norway (RDC) have changed the data extraction pipeline affecting bulls with daughter phenotypes prior to 2004

### Fertility

- France, Nederland, Canada, and Germany (HOL) have changed base
- New Zealand (all) have changed pedigree extract and changed base
- Italy (HOL) have cut-off of one year of data causing drops in information and changed base
- USA (HOL) have drops in information are due to pedigree corrections and herd-year minimum edits

### Calving

- Italy (HOL) have cut-off of one year of data, changed base and modified dataedit
- USA (HOL) have drops in information are due to pedigree corrections and herd-year minimum edits
- Germany (HOL) have base change and decrease in information due to update on pedigree information of cross bred calves
- New Zealand (all) have changed pedigree extract and changed base
- Canada and Nederland (HOL) have changed base
- Norway (RDC) have changed evaluating for calving ease to a multitrait evaluation together with stillbirth, calf size and gestation length.

### Conformation

- France and Canada (HOL) have changed base
- Germany (HOL) have base change. Further a new trait definition for ANG trait and new heritability (0,11)
- USA (HOL) have decrease in information due to parentage checks
- New Zealand (all) have changed pedigree extract
- Norway (RDC) have changed definition and weights used to construct OUS
- Nederlands (HOL) have changed model with inclusion of data from the automatic milking systems in the flow. Further extra data edits for udder traits and base changed
- Italy (HOL) have cut-off of one year of data and changed base

### Udder health

- USA (HOL) are participating with real MAS data. Drops in information are due to pedigree corrections and herd-year minimum edits
- France, Canada, Nederlands and Germany (HOL) have changed base
- Italy (HOL) have cut-off of one year of data and changed base
- New Zealand (all) have changed pedigree extract
- Norway (RDC) have changed data extraction pipeline that affects bulls with daughter phenotypes prior to 2004

### Longevity

- France, Canada, Nederlands and Germany (HOL) have changed base
- Italy (HOL) have cut-off of one year of data and changed base
- USA (HOL) have drops in information are due to pedigree corrections and herd-year minimum edits
- New Zealand (all) have changed pedigree extract

### Milking speed and temperament

- France, Canada and Germany (HOL) have changed base
- New Zealand (all) have changed pedigree extract
- Nederlands (HOL) have changed model with the inclusion of data from the automatic milking systems in the flow and changed base.

## 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	61	100,7	111,7	105,0	108,5	7,6
Belgium	10	112,9	118,4	114,4	116,3	3,9
Canada	376	112,6	124,2	115,1	119,3	10,3
Switzerland	17	103,5	107,4	104,5	105,8	9,7
Czech Republic	35	117,2	118,0	117,5	117,7	5,8
Germany	414	117,1	116,5	119,0	118,4	6,9
DNK/FIN/SWE	95	100,1	121,9	114,7	120,5	5,7
Spain	71	115,3	112,8	113,7	113,1	8,7
France	354	109,3	110,3	112,4	112,2	7,1
UK	31	105,9	121,4	112,3	117,1	18,1
Hungary	6	113,2	109,8	107,7	107,2	8,0
Italy	89	114,8	116,9	117,9	118,2	7,2
Netherlands	273	110,6	118,2	116,2	118,1	8,1
Poland	52	112,5	114,2	114,6	114,9	5,8
USA	1119	113,6	127,0	117,8	122,4	6,8

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.

Country	No	Frame		Feet&legs		Udder	
		Average	STD	Average	STD	Average	STD
Australia	18	110,8	12,6	99,8	4,3	110,8	9,0
Belgium	10	115,1	8,7	107,0	5,8	112,2	8,2
Canada	376	115,8	11,9	99,9	4,7	110,7	9,3
Switzerland	17	125,1	8,4	101,5	3,1	122,6	7,6
Czech Republic	35	112,3	6,6	101,0	5,2	106,3	8,1
Germany	414	110,7	9,0	104,5	5,0	112,2	8,1
DNK/FIN/SWE	91	104,0	9,3	102,6	4,7	110,4	7,3
Spain	71	113,4	9,8	105,0	4,0	114,6	8,7
France	354	117,7	8,9	104,6	4,2	118,3	8,2
UK	31	103,6	10,4	97,6	2,8	97,9	12,7
Hungary	6	110,3	6,4	99,7	3,3	108,8	4,1
Italy	89	114,8	8,2	100,6	4,1	111,3	7,2
Netherlands	273	110,6	8,8	107,1	7,2	105,7	8,1
Poland	52	114,0	7,5	101,8	3,3	109,7	9,5
USA	1119	108,6	9,6	98,3	4,4	104,1	7,5

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	11	97,7	2,5
Belgium	10	99,9	3,0
Canada	376	99,0	5,0
Switzerland	17	99,6	5,7
Czech Republic	22	98,4	4,7
Germany	412	102,8	6,0
DNK/FIN/SWE	90	105,4	5,6
Spain	71	102,9	7,4
France	327	107,6	6,3
UK	31	97,9	5,0
Hungary	6	90,9	4,5
Italy	89	103,1	6,7
Netherlands	273	101,5	5,5
Poland	52	105,4	6,6
USA	1119	99,3	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 2020 or later.

Country	No. of bulls	Average	STD
Australia	18	106,1	6,2
Belgium	10	107,1	7,7
Canada	376	108,3	6,5
Switzerland	17	102,1	6,5
Czech Republic	22	107,8	4,1
Germany	414	114,5	6,0
DNK/FIN/SWE	95	112,7	6,0
Spain	71	110,5	8,1
France	354	110,5	5,8
UK	31	106,2	9,2
Hungary	6	101,3	6,1
Italy	89	109,1	5,5
Netherlands	273	111,1	6,5
Poland	52	108,7	5,8
USA	1119	109,6	4,7

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	18	99,9	4,4	17	102,8	3,0
Belgium	10	98,3	3,8	10	104,1	5,0
Canada	375	99,8	4,2	376	103,1	5,1
Switzerland	17	98,2	4,6	17	102,6	5,4
Czech Republic	22	100,0	4,1	22	103,4	4,4
Germany	412	100,2	4,0	414	101,6	5,1
DNK/FIN/SWE	91	101,1	4,2	91	101,8	4,4
Spain	71	100,1	4,6	66	100,0	5,2
France	327	98,4	3,9	327	101,7	4,9
UK	30	102,2	3,1	28	103,7	4,6
Hungary	6	98,2	4,6	6	101,0	1,4
Italy	89	99,7	3,3	89	101,5	3,6
Netherlands	271	101,4	3,9	273	101,1	4,9
Poland	52	96,9	3,9	52	101,2	5,0
USA	1113	101,4	3,3	1119	104,6	4,0

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 2020 or later.

Country	No. of bulls	Average	STD
Australia	18	103,3	4,7
Belgium	10	98,6	7,4
Canada	376	97,4	6,4
Switzerland	17	98,4	8,6
Czech Republic	22	97,2	7,0
Germany	414	101,6	6,5
DNK/FIN/SWE	91	106,2	7,1
Spain	71	100,2	7,5
France	327	102,7	6,3
UK	31	101,3	5,0
Italy	89	100,6	5,8
Netherlands	273	99,4	7,6
Poland	52	98,9	6,1
USA	1119	100,6	5,0

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	17	103,5	15,4	16	106,2	2,1
Belgium	10	99,4	4,4	8	101,8	7,6
Canada	371	99,7	5,4	332	105,6	6,9
Switzerland	17	102,1	4,5	6	102,9	1,5
Czech Republic	20	97,6	7,8			
Germany	414	97,2	5,8	411	104,5	8,5
DNK/FIN/SWE	95	101,6	1,6	94	104,1	2,4
Spain	71	96,5	2,9	64	103,3	2,2
France	354	94,7	3,3	326	105,2	5,0
UK	28	100,2	9,2	26	104,8	0,6
Italy	86	95,8	8,5	83	104,8	4,2
Netherlands	273	95,9	5,3	272	103,4	10,5
Poland	52	93,2	14,1	46	101,8	6,8
USA	1049	100,9	3,7	1010	104,9	4,1

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 April 2023 the following changes are done compared to December 2022 routine evaluation:

### Yield:

- Canada, France, Germany and Netherlands have base change
- Italy cut off one year of data and change base

### Fertility:

- Canada, France, Germany and Netherlands have base change
- Italy cut off one year of data and change base
- DFS has changed status of bulls

### Calving:

- Canada and Germany have base change
- Italy has base change, one year cut off data and modified data editing criteria
- Netherlands has changed base and heritability of MCE

### Conformation:

- Canada France and Netherlands have base change
- Italy has base change and cut off one year
- Germany has changed base and have new trait definition and heritability for trait ANG

### Udder health:

- Canada France, Germany and Netherlands have base change
- Italy has base change and cut off one year

### Longevity:

- Canada France, Germany and Netherlands have base change
- Italy has base change and cut off one year

### Milking speed and temperament:

- Canada France and Germany have base change
- Netherlands has base change and change heritability

## Dates of publication of Interbull breeding values in 2023:

Month	Date
April	4
August	8
December	7

The indices can be found at the national databases in Denmark, Sweden, and Finland 2-3 days after they have been published by Interbull.

Regards

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