

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 $\frac{1}{2} (EBV_{\text{sire}} - 100) + \frac{1}{4} (EBV_{\text{maternal grand sire}} - 100) + 100$. The contributions from the sire and maternal grand sire can be based on either NAV breeding values or international breeding values. If EBV_{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 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.

| Country | No | Frame | | Feet&legs | | Udder | |
|----------------|------|---------|------|-----------|-----|---------|-----|
| | | 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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