INTRODUCTION

The latest genomic routine international evaluation for females fertility traits took place as scheduled at the Interbull Centre. Data from 18 countries were included in this evaluation.

International genetic evaluations for female fertility traits of bulls from Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Ireland, Israel, Italy, Netherlands, New Zealand, Norway, Poland, Spain, Sweden, Switzerland, South Africa, Japan, the United Kingdom and the United States of America were computed. Holstein data were included in this evaluation.

BEL, CAN, DEU, ESP, FRA, DFS, GBR, ITA, NLD, POL submitted GEBVs.

cc1: CAN, DEU, , FRA, DFS, GBR, ITA, NLD, POL
cc2: BEL, CAN, DEU, ESP, , DFS, GBR, ITA, NLD, POL
crc: BEL, CAN, DEU, ESP, FRA, DFS, GBR, ITA, NLD, POL
hco: CAN, DEU, , FRA, DFS, , ITA, NLD, POL
int: BEL, CAN, DEU, ESP, , DFS, GBR, ITA, NLD, POL

Based on a decision made by Interbull Steering committee in August 2007, female fertility traits are classified as follows:

T1 (HC): Maiden (H)eifer's ability to (C)onceive. A measure of confirmed conception, such as conception rate (CR), will be considered for this trait group. In the absence of confirmed conception an alternative measure, such as interval first-last insemination (FL), interval first insemination-conception (FC), number of inseminations (NI), or non-return rate (NR,preferably NR56) can be submitted;
T2 (CR): Lactating (C)ow's ability to (R)ecycle after calving. The interval calving-first insemination (CF) is an example for this ability. In the abscence of such a trait, a measure of the interval calving-conception, such as says oprn (DO) or calving interval (CI) can be submitted;
T3 (C1): Lactating (C)ow's ability to conceive (1), expressed as a rate trait. Traits like conception rate (CR) and non-return rate (NR, preferably NR56) will be considered for this trait group;
T4 (C2): Lactating (C)ow's ability to conceive (2), expressed as an interval trait. The interval first insemination-conception (FC) or interval first-last insemination (FL) will be considered for this trait group. As an alternative, number of inseminations (NI) can be submitted. In the abscence of any of these traits, a measure of interval calving-conception such as days open (DO), or calving interval (CI) can be submitted. All countries are expected to submit data for this trait group, and as a last resort the trait submitted under T3 can be submitted for T4 as well.
T5 (IT): Lactating cow's measurements of (I)nterval (T)raits calving-conception, such as days open (DO) and calving interval (CI).

Based on the above trait definitions the following traits have been submitted for international genetic evaluation of female fertility traits.

Country	Traits	Submitted traits and their definitions
AUS	T2=CY	Calving interval converted to 42 days pregnancy rate
	T4=C2	Calving interval converted to 42 days pregnancy rate
	T5=IT	Calving interval converted to 42 days pregnancy rate
BEL	T2=CY	PR=Pregnancy Rate (=[21/(DO-45+11)]*100, with DO=days open)
	T4=C2	PR=Pregnancy Rate (=[21/(DO-45+11)]*100, with DO=days open)
	T5=IT	PR=Pregnancy Rate (=[21/(DO-45+11)]*100, with DO=days open)
CAN	T1=HC	NR=Non Return Rate after 56 Days in heifers (NRR), %

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         T2=CY   CF=Interval from Calving to First Service in cows(CF)
         T3=C1   NR=Non Return Rate after 56 Days in cows(NRR), %
         T4=C2   FC=Interval first insemination-conception in cows
         T5=IT   DO=Days open

CHE      T1=HC   CR=Heifers' Conception rate
         T2=CR   CF=Interval from Calving to First Service (ICF), days
         T3=C1   NR=Non Return Rate after 56 Days (NRR), %
         T4=C2   NR=Non Return Rate after 56 Days (NRR), %

CZE      T1=HC   CR=Heifers' Conception rate (pregnant or not after 3 months)
         T3=C1   CR=Cows' Conception rate (pregnant or not after 3 months)
         T4=C2   CR=Cows' Conception rate (pregnant or not after 3 months)

AUT/DEU  T1=HC   NR=Heifers' Non Return Rate after 56 days
         T2=CY   CF=Interval from calving to first insemination cows (days)
         T3=C1   NR=Cows' Non Return Rate after 56 days
         T4=C2   FL=Interval from first to last insemination cows (days)
         T5=IT   DO=Days open (days)

DFS      T1=HC   NR=Heifers' Non Return Rate after 56 days
         T2=CY   CF=Interval from calving to first insemination cows (days)
         T3=C1   NR=Cows' Non Return Rate after 56 days
         T4=C2   FL=Interval from first to last insemination cows (days)
         T5=IT   DO=Days open (days)

ESP      T2=CY   DO=Days open
         T4=C2   DO=Days open
         T5=IT   DO=Days open

FRA      T1=HC   CR=Heifers' Conception rate (binary trait) for maiden heifers
  T2=CY  Interval between calving and first AI
         T3=C1   CR=Cows' Conception rate (binary trait) for cows
  T4=C2   FL=Interval from first to last insemination cows (days)

GBR      T2=CY   CI=days between 1st and 2nd calvings
         T3=C1   NR=1st lactation non return at 56 days
         T4=C2   CI=days between 1st and 2nd calvings
         T5=IT   CI=days between 1st and 2nd calvings

IRL      T2=CY   CI=Calving interval
         T4=C2   CI=Calving interval
         T5=IT   CI=Calving interval

ISR      T3=C1   CR=Inverse of the number of insemination to conception (%)
         T4=C2   CR=Inverse of the number of insemination to conception (%)

ITA      T1=HC   NR= non-return rate 56 days (heifers)
         T2=CY   CF=Days to first service
         T3=C1   NR=Non-return rate at 56 days (%)
         T4=C2   FL=Interval from first to last insemination cows (days)
         T5=IT   DO=days open (days)

ITA(BSW) T2=CY   CF=Interval calving to first insemination
         T4=C2   Days Open
         T5=IT   CI=Calving interval

NLD      T1=HC   CR=Heifers' Conception rate
         T2=CY   CF=Interval calving to first insemination (days)
         T3=C1   CR=Cows' Conception rate (binary trait) for cows
         T4=C2   FL=Interval from first to last insemination cows (days)
         T5=IT   CI=Calving Interval (days)

NOR      T1=HC   NR=NR=Non-return rate 56 days (heifers)
         T2=CY   CF=Interval calving to first insemination (days)
         T3=C1   NR=NR=Non-return rate 56 days (cows)
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         T4=C2   CI=Calving Interval (days)
         T5=IT   CI=Calving Interval (days)

NZL      T2=CY   PM=Lactating cow's ability to start cycling
         T4=C2   PC=Lactating cow's ability to conceive (CR42)
         T5=IT   PC=Lactating cow's ability to conceive (CR42)

POL      T1=HC  CR=Conception rate for heifers
  T2=CR  Interval from calving to first insemination
         T3=C1  CR=Conception rate for cows
         T4=IT  Days open
         T5=IT  Days open

USA      T1=HC   CR=Conception rate (heifer)
         T2=CY   CF=Interval from calving to first insemination
         T3=C1   CR=Conception rate (cow)
         T4=C2   DP=Daughter Pregnancy Rate
         T5=IT   DP=Daughter Pregnancy Rate

ZAF  T4=IT   CI=Calving Interval
      T5=IT   CI=Calving Interval

JPN      T1=HC   CR=Heifers'Conception rate
         T2=CY   DO=Days open
         T3=C1   CR=Cows'Conception rate
         T4=C2   DO=Days open
         T5=IT   DO=Days open
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CHANGES IN NATIONAL PROCEDURES

Changes in the national genetic evaluation of fertility traits are as follows:

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DEU (HOL)   Base change
CAN (HOL)   Base change
ITA (HOL)   Base change
GBR (HOL)   Base change
FRA (HOL)   Base change
NLD (HOL)   Base change
POL (HOL)   Base change
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INTERBULL CHANGES COMPARED TO THE DECEMBER ROUTINE RUN

No changes in Interbull procedures

DATA AND METHOD OF ANALYSIS

Eleven Holstein populations sent GEBV data for up to 38 traits, while classical EBVs for the same traits were used in the analyses. Young bull GEBVs from the GEBV providers have been converted to the scales of all countries participating in classical MACE. A bull will get a MACE EBV or a GMACE EBV but not both.
From those eleven countries, National GEBVs of bulls less than seven years of age and with no classical MACE proofs were included for the breeding value prediction with a further requirement of either a MACE-PA or a GMACE-PA (for young genomic bulls with young genomic sires) being available.

The parameter-space approach is used for the GMACE genetic evaluations (Sullivan, 2016)

SCIENTIFIC LITERATURE

The international genetic evaluation procedure is based on international work

described in the following scientific publications:

Sullivan, P.G. 2016. Defining a Parameter Space for GMACE. Interbull Bulletin 50, p 85-93.

VanRaden, P.M. and Sullivan, P.G. 2010. International genomic evaluation methods for dairy cattle. Gen. Sel. Evol. 42:7

Sullivan, P.G. and Jakobsen, J.H. 2012. Robust GMACE for young bulls methodology. Interbull Bulletin 45, Article 1.

Sullivan, P.G. 2012a. GMACE reliability approximation. Report to the GMACE working group of Interbull. GMACE_rels 2013

Sullivan, P.G. 2012b. GMACE variance estimation. Report to the GMACE working group of Interbull. GMACE_vce 2013

Sullivan, P.G. 2012c. GMACE Weighting Factors. Report to the GMACE working group of Interbull. GMACE_gedcs 2013

Jakobsen, J.H. and Sullivan, P.G. 2013. Trait specific computation of shared reference population. Reference sharing Nov 2013

NEXT ROUTINE INTERNATIONAL EVALUATION

Dates for next routine run can be found on http://www.interbull.org/ib/servicecalendar

NEXT TEST INTERNATIONAL EVALUATION

Dates for next routine run can be found on http://www.interbull.org/ib/servicecalendar

PUBLICATION OF INTERBULL ROUTINE RUN

Results were distributed by the Interbull Centre to designated representatives in each country. The international evaluation file comprised international proofs expressed on the base and unit of each country included in the analysis. Such records readily provide more information on bull performance in various countries, thereby minimising the need to resort to conversions.

At the same time, all recipients of Interbull results are expected to honour the agreed code of practice, decided by the Interbull Steering Committee, and only publish international evaluations on their own country scale. Evaluations expressed on another country scale are confidential and may only be used internally for research and review purposes.

Table 1. National evaluation dates in GMACE run April 2020

Country	Date
BEL	20190901
CAN	20200401
DEU	20200407
DFS	20200302
ESP	20200317
GBR	20200225
ITA	20200309
NLD	20200401
POL	20200228
FRA	20200408

Table 2.

Number of bulls in reference population for	hco
CAN	33608.0

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DEU  5760.0 37441.0
DFS  3688.0 33478.0 34263.0
FRA  3681.0 31884.0 31376.0 33682.0
POL  3956.0 29033.0 28838.0 27618.0 30932.0
NLD  3691.0 33127.0 32634.0 31588.0 28562.0 34388.0
ITA 27220.0  4626.0  2852.0  2802.0  2993.0  2749.0 27724.0

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Number of bulls in reference population for        crc
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BEL  2683.0
CAN  1641.0 33419.0
DEU  1299.0  5959.0 39777.0
DFS  1091.0  3801.0 35700.0 36560.0
ESP  1235.0  4165.0 36308.0 35804.0 37120.0
GBR  1270.0 30045.0  6034.0  3850.0  4212.0 31860.0
ITA  1547.0 29644.0  4780.0  2948.0  3226.0 28374.0 30174.0
NLD  1208.0  3813.0 35368.0 34922.0 35400.0  3941.0  2872.0 37271.0
POL  1367.0  3916.0 31292.0 31159.0 31512.0  3707.0  3025.0 30866.0 32617.0
FRA  1241.0  3841.0 33894.0 33431.0 33953.0  3851.0  2951.0 33646.0 29676.0 35784.0

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Number of bulls in reference population for        cc1
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CAN 36477.0
DEU  5888.0 37764.0
DFS  3725.0 33690.0 34470.0
FRA  3766.0 32096.0 31575.0 33908.0
GBR 30074.0  5967.0  3781.0  3792.0 31206.0
ITA 29660.0  4719.0  2886.0  2899.0 28343.0 30171.0
NLD  3742.0 33341.0 32832.0 31763.0  3790.0  2808.0 34657.0
POL  3978.0 29263.0 29063.0 27834.0  3713.0  3029.0 28773.0 31132.0

-----------------------------------------------------
Number of bulls in reference population for        cc2
-----------------------------------------------------
BEL  3143.0
CAN  1791.0 38934.0
DEU  1323.0  6018.0 39930.0
DFS  1103.0  3862.0 35809.0 36685.0
ESP  1252.0  4232.0 36418.0 35927.0 37254.0
GBR  1366.0 32468.0  6082.0  3888.0  4255.0 34315.0
ITA  1634.0 31435.0  4796.0  2960.0  3240.0 30131.0 31966.0
NLD  1237.0  3885.0 35467.0 35023.0 35506.0  3966.0  2900.0 37561.0
POL  1736.0  4103.0 31395.0 31261.0 31617.0  3808.0  3104.0 30975.0 33346.0

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Number of bulls in reference population for        int
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BEL  2275.0
CAN  1221.0 37090.0
DEU  1284.0  5949.0 39811.0
DFS  1091.0  3821.0 35733.0 36604.0
ESP  1231.0  4183.0 36338.0 35849.0 37164.0
GBR  1270.0 32309.0  6057.0  3870.0  4233.0 34155.0
ITA  1133.0 30113.0  4768.0  2955.0  3230.0 30056.0 30640.0
NLD  1204.0  3820.0 35395.0 34953.0 35427.0  3948.0  2890.0 37421.0
POL  1283.0  3633.0 31318.0 31189.0 31538.0  3709.0  2763.0 30885.0 32353.0
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