INTRODUCTION

The latest genomic test international evaluation for females fertility traits took place as scheduled at the Interbull Centre. Data from 20 countries were included in this evaluation.

International genetic evaluations for fertility traits of bulls were computed from:
AUS BEL CAN CHE CZE DEU DFS ESP FRA GBR IRL ISR ITA NLD NZL POL USA ZAF URY JPN
Holstein data were included in this evaluation.

BEL, CAN, DEU, 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), %
	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)
	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

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         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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FRA (HOL)    Changes in proof for some bulls due to changes in their information and consequent change in their status
DFS (HOL)    Drops in reliability, reliability submitted in April have been found too high
ESP (HOL)    New GEBVS are calculated with SNPBLUP applying afterwards the f factor described by the Interbull genomic reliability
             method for adjusting genomic reliabilities.
GBR (HOL)    Changes in status due to changes on the genotypic information being avilable for some bulls. Changes in type of proof due
             to updates on pedigree and daughter information
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INTERBULL CHANGES COMPARED TO THE DECEMBER ROUTINE RUN

No changes in Interbull procedures

DATA AND METHOD OF ANALYSIS

Thirteen 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 thirteen 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

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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 August 2021

Country	Date
BEL	20201201
CAN	20210801
DEU	20210810
DFS	20210710
ESP	20210701
GBR	20210630
ITA	20210714
NLD	20210801
POL	20210810
FRA	20210811

Table 2.

Number of bulls in reference population for hco

CAN	35353.0					
DEU	7776.0	40044.0				
DFS	4591.0	34756.0	35757.0			
FRA	3807.0	32287.0	31745.0	33859.0		
POL	4383.0	29914.0	29684.0	27831.0	31766.0	
NLD	3894.0	33786.0	33185.0	31784.0	29009.0	34879.0
ITA	28852.0	6499.0	3577.0	3014.0	3319.0	3077.0	29684.0

Number of bulls in reference population for crc

BEL	1483.0						
CAN	728.0	35297.0					
DEU	717.0	8097.0	42584.0				
DFS	633.0	4757.0	37086.0	38141.0			
ESP	698.0	5479.0	38072.0	37321.0	39199.0		
GBR	670.0	31860.0	8390.0	4994.0	5787.0	34202.0	
ITA	717.0	31381.0	6786.0	3729.0	4232.0	30252.0	32260.0

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NLD   738.0  4080.0 36160.0 35591.0 36203.0  4394.0  3254.0 37920.0
POL   845.0  4401.0 32311.0 32122.0 32643.0  4389.0  3403.0 31480.0 33593.0
FRA   701.0  4027.0 34426.0 33897.0 34504.0  4100.0  3213.0 33951.0 30024.0 36109.0

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Number of bulls in reference population for        cc1
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CAN 38318.0
DEU  7985.0 40444.0
DFS  4627.0 34943.0 35897.0
FRA  3913.0 32511.0 31926.0 34152.0
GBR 31847.0  8261.0  4842.0  3981.0 33364.0
ITA 31363.0  6679.0  3620.0  3113.0 30169.0 32206.0
NLD  3975.0 33993.0 33357.0 31964.0  4190.0  3144.0 35180.0
POL  4414.0 30146.0 29888.0 28068.0  4329.0  3354.0 29249.0 31936.0

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Number of bulls in reference population for        cc2
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BEL  1677.0
CAN   751.0 40869.0
DEU   722.0  8182.0 42776.0
DFS   635.0  4816.0 37205.0 38258.0
ESP   701.0  5544.0 38196.0 37436.0 39324.0
GBR   686.0 34305.0  8460.0  5021.0  5819.0 36692.0
ITA   731.0 33114.0  6815.0  3746.0  4253.0 31954.0 33993.0
NLD   743.0  4167.0 36269.0 35696.0 36312.0  4438.0  3286.0 38241.0
POL  1017.0  4591.0 32421.0 32226.0 32749.0  4496.0  3483.0 31602.0 34298.0

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Number of bulls in reference population for        int
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BEL  1340.0
CAN   578.0 38959.0
DEU   717.0  8088.0 42617.0
DFS   633.0  4772.0 37121.0 38165.0
ESP   698.0  5494.0 38107.0 37349.0 39224.0
GBR   670.0 34134.0  8418.0  4996.0  5791.0 36505.0
ITA   571.0 31698.0  6769.0  3736.0  4237.0 31868.0 32564.0
NLD   738.0  4103.0 36194.0 35624.0 36231.0  4417.0  3274.0 38098.0
POL   766.0  4120.0 32337.0 32144.0 32661.0  4387.0  3141.0 31510.0 33327.0
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