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

	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

CHANGES IN NATIONAL PROCEDURES

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

ITA (HOL) Decrease in reliability due to changes in bull population
ESP (HOL) Changed the reference genome and the imputing process, new check on genotypes and Interbull Method for gebv reliability. (GEBV test OK)
GBR (HOL) Some animals affected by change in genomic information

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

Dates for next test 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 August 2023

Country	Date
BEL	20201201
CAN	20230801
DEU	20230808
DFS	20230808
ESP	20230710
GBR	20230710
ITA	20230704
NLD	20230801
POL	20230310
FRA	20230809

Table 2.

Number of bulls in reference population for	hco						
CAN	37232.0						
DEU	10353.0	43435.0					
DFS	5135.0	35997.0	36869.0				
FRA	3834.0	32356.0	31727.0	33903.0			
POL	4699.0	31083.0	30564.0	27853.0	32562.0		
NLD	3911.0	33950.0	33216.0	31801.0	29063.0	34937.0	
ITA	31287.0	9638.0	4427.0	3108.0	4078.0	3269.0	32655.0

Number of bulls in reference population for	crc						
BEL	1458.0						
CAN	706.0	37285.0					
DEU	723.0	10787.0	46195.0				
DFS	624.0	5349.0	38470.0	39404.0			
ESP	700.0	6837.0	40351.0	38447.0	41223.0		
GBR	672.0	33863.0	11552.0	5950.0	7517.0	36365.0	
ITA	696.0	33922.0	10083.0	4647.0	6151.0	33348.0	35400.0
NLD	738.0	4128.0	36389.0	35679.0	36336.0	4487.0	3485.0	38065.0

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POL   822.0  4756.0 33644.0 33166.0 33825.0  5290.0  4141.0 31606.0 34562.0
FRA   701.0  4061.0 34517.0 33900.0 34578.0  4142.0  3315.0 33989.0 30067.0 36170.0

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Number of bulls in reference population for        cc1
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CAN 40292.0
DEU 10651.0 43919.0
DFS  5192.0 36180.0 37008.0
FRA  3951.0 32593.0 31926.0 34214.0
GBR 33805.0 11347.0  5729.0  4015.0 35860.0
ITA 33979.0  9918.0  4470.0  3212.0 33208.0 35373.0
NLD  4005.0 34172.0 33406.0 31994.0  4264.0  3351.0 35261.0
POL  4743.0 31330.0 30803.0 28107.0  5140.0  4108.0 29320.0 32722.0

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Number of bulls in reference population for        cc2
--------------------------------------------------------
BEL  1650.0
CAN   729.0 42922.0
DEU   728.0 10909.0 46431.0
DFS   626.0  5414.0 38594.0 39522.0
ESP   703.0  6921.0 40490.0 38586.0 41386.0
GBR   687.0 36007.0 11631.0  5970.0  7560.0 38529.0
ITA   719.0 36307.0 10173.0  4676.0  6193.0 35458.0 37807.0
NLD   741.0  4205.0 36493.0 35781.0 36444.0  4531.0  3522.0 38350.0
POL   993.0  4954.0 33760.0 33280.0 33943.0  5384.0  4312.0 31708.0 35234.0

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Number of bulls in reference population for        int
--------------------------------------------------------
BEL  1401.0
CAN   581.0 41140.0
DEU   723.0 10786.0 46229.0
DFS   624.0  5367.0 38504.0 39423.0
ESP   700.0  6862.0 40390.0 38496.0 41273.0
GBR   672.0 35851.0 11578.0  5948.0  7533.0 38358.0
ITA   574.0 34902.0 10078.0  4653.0  6160.0 35315.0 36368.0
NLD   738.0  4154.0 36424.0 35717.0 36371.0  4513.0  3506.0 38249.0
POL   764.0  4686.0 33671.0 33198.0 33852.0  5296.0  4069.0 31638.0 34514.0
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