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INTRODUCTION
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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.

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Country  Traits  Submitted traits and their definitions
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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
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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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CAN (HOL)    Base change
DFS (HOL)    Change in status of bulls
FRA (HOL)    Base change
ITA (HOL)    Cut off one year of data and base change
NLD (HOL)    INT: Now send Days open instead of Calving Interval. Conception rate heifers and cows:
             added the used sire to the model and done some minor data edits.
ESP (HOL)    Exclusion from national genomic evaluation of candidates and culled bulls older than 2 years old.
             Reduction in reliability due to reduction of parent average's reliability
DEU (HOL)    Base change
GBR (HOL)    Base change
BEL (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

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 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 2021

Country Date

BEL   20201201
CAN   20210401
DEU   20210407
DFS   20210302
ESP   20210319
GBR   20210309
ITA   20210311
NLD   20210401
POL   20210407
FRA   20210407
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Table 2.

Number of bulls in reference population for   hco

CAN 34993.0
DEU 7295.0 39438.0
DFS 4384.0 34498.0 35385.0
FRA 3801.0 32252.0 31713.0 33843.0
POL 4266.0 29715.0 29518.0 27811.0 31554.0
NLD 3870.0 33665.0 33116.0 31747.0 28925.0 34785.0
ITA 28949.0 6367.0 3498.0 3009.0 3319.0 3074.0 29685.0

Number of bulls in reference population for   crc

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BEL  1484.0
CAN   728.0 34897.0
DEU   717.0  7579.0 41911.0
DFS   628.0  4525.0 36772.0 37710.0
ESP   692.0  4948.0 37551.0 36754.0 38362.0
GBR   669.0 31491.0  7815.0  4734.0  5155.0 33746.0
ITA   717.0 31463.0  6631.0  3632.0  4082.0 30341.0 32237.0
NLD   738.0  4025.0 35979.0 35468.0 35973.0  4297.0  3229.0 37764.0
POL   846.0  4258.0 32057.0 31909.0 32251.0  4194.0  3382.0 31340.0 33336.0
FRA   700.0  3996.0 34347.0 33822.0 34395.0  4061.0  3193.0 33871.0 29960.0 36046.0

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Number of bulls in reference population for      cc1
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CAN 37943.0
DEU 7490.0 39819.0
DFS 4419.0 34675.0 35525.0
FRA 3900.0 32469.0 31888.0 34123.0
GBR 31498.0  7713.0  4618.0  3963.0 32951.0
ITA 31459.0  6544.0  3541.0  3108.0 30279.0 32204.0
NLD 3940.0 33866.0 33283.0 31921.0  4118.0  3140.0 35075.0
POL 4297.0 29940.0 29728.0 28041.0  4168.0  3354.0 29160.0 31743.0

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Number of bulls in reference population for      cc2
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BEL  1677.0
CAN   751.0 40457.0
DEU   722.0  7661.0 42100.0
DFS   630.0  4583.0 36890.0 37834.0
ESP   695.0  5018.0 37676.0 36887.0 38508.0
GBR   685.0 33935.0  7883.0  4769.0  5207.0 36235.0
ITA   731.0 33195.0  6660.0  3645.0  4100.0 32043.0 33969.0
NLD   743.0  4107.0 36085.0 35567.0 36084.0  4333.0  3262.0 38075.0
POL  1017.0  4451.0 32168.0 32019.0 32364.0  4307.0  3462.0 31457.0 34055.0

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Number of bulls in reference population for      int
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BEL  1341.0
CAN   578.0 38562.0
DEU   717.0  7571.0 41947.0
DFS   628.0  4541.0 36808.0 37745.0
ESP   692.0  4969.0 37588.0 36804.0 38412.0
GBR   669.0 33766.0  7846.0  4746.0  5180.0 36050.0
ITA   571.0 31777.0  6613.0  3635.0  4084.0 31955.0 32537.0
NLD   738.0  4043.0 36009.0 35495.0 36003.0  4311.0  3248.0 37933.0
POL   767.0  3979.0 32085.0 31940.0 32280.0  4200.0  3119.0 31365.0 33077.0
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