Introduction

The latest routine international evaluation for females fertility traits took place as scheduled at the Interbull Centre. Data from seventeen (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, the United Kingdom and the United States of America were computed. Holstein data were included in this evaluation.

CAN, DEU, DFS, FRA, GBR, ITA, NLD, POL and ESP contributed with GEBVs.

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

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	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), %
CHR	T2=CR	CF=Interval from Calving to First Service (ICF), days
	T3=C1	NR=Non Return Rate after 56 Days (NRR), %
	T4=C2	NR=Cows' Non Return Rate after 56 Days (NRR), binary
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	CR=Cows' Conception rate (binary trait) for cows
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	T2=CY	CF=Days to first service
	T3=C1	NR=Non-return rate at 56 days (%)
	T4=C2	CI=Calving Interval (days)
	T5=IT	CI=Calving interval (days)
ITA(BSW)	T2=CY	CF=Interval calving to first insemination
	T4=C2	Days Open
	T5=IT	CI=Calving interval
NLD	T2=CY	CF=Interval calving to first insemination (days)
	T3=C1	NR=Non-return rate 56 days (binary trait)
	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 Non return rate at 56 days for heifer
T2=CR Interval from calving to first insemination
T3=C1 Non return rate at 56 days 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

CHANGES IN NATIONAL PROCEDURES

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

NOR RDC The rolling definition of hys is causing the daughters to distribute somewhat differently over hys-classes at each evaluation. Therefore some bulls occasionally may lose EDC although the number of daughters stay the same. Reliability changes is a function of the EDC changes.

FRA(HOL): First time participation for "int"

USA: Evaluated daughter pregnancy rate (traits cc2 and int) using a multi-trait fertility model
with a revised DPR trait definition. Revised the formula to estimate calving to first insemination (trait crc) from traits int and cc1.
Changed the base for all fertility traits.

ZAF(JER): Inclusion of more data and change in heritability (cc2,int)

INTERBULL CHANGES COMPARED TO THE DECEMBER ROUTINE RUN

No changes in Interbull procedures

DATA AND METHOD OF ANALYSIS

Data were national genetic evaluations of AI sampled bulls with at least 10 daughters or 10 EDC (for clinical mastitis and maternal calving traits at least 50 daughters or 50 EDC, and for direct calving traits at least 50 calvings or 50 EDC) in at least 10 herds. Table 1 presents the amount of data included in this Interbull evaluation for all breeds.

National proofs were first de-regressed within country and then analysed jointly with a linear model including the effects of evaluation country, genetic group of bull and bull merit. Heritability estimates used in both the de-regression and international evaluation were as in each country's national evaluation.

Table 2 presents the date of evaluation as supplied by each country in the 01x-proof file.

Estimated genetic parameters and sire standard deviations are shown in APPENDIX I and the corresponding number of common bulls are listed in APPENDIX II.

SCIENTIFIC LITERATURE

The international genetic evaluation procedure is based on international work described in the following scientific publications:

International genetic evaluation computation:
- Schaeffer. 1994. J. Dairy Sci. 77:2671-2678
- Klei, 1998. Interbull Bulletin 17:3-7

Verification and Genetic trend validation:
- Klei et al., 2002. Interbull Bulletin 29:178-182.
- Boichard et al., 1995. J. Dairy Sci. 78:431-437

Weighting factors:
- Fikse and Banos, 2001. J. Dairy Sci. 84:1759-1767

De-regression:
- Sigurdsson and G. Banos. 1995. Acta Agric. Scand. 45:207-219
- Jairath et al. 1998. J. Dairy Sci. Vol. 81:550-562

Genetic parameter estimation:
- Klei and Weigel, 1998, Interbull Bulletin 17:8-14
- Sullivan, 1999. Interbull Bulletin 22:146-148

Post-processing of estimated genetic correlations:
- Mark et al., 2003, Interbull Bulletin 30:126-135
- Jorjani et al., 2003. J. Dairy Sci. 86:677-679
- https://wiki.interbull.org/public/rG%20procedure?action=print

Time edits
- Weigel and Banos. 1997. J. Dairy Sci. 80:3425-3430

International reliability estimation
- Harris and Johnson. 1998. Interbull Bulletin 17:31-36

NEXT ROUTINE INTERNATIONAL EVALUATION

The next routine evaluation of Interbull for production, conformation, udder health, longevity, calving, female fertility and workability traits is scheduled for April 2015. Deadline for sending data to the Interbull Centre is Tuesday November 18, 2014, 17:00 CET; confidential distribution of results is targeted for Wednesday November 26, 2014, with earliest possible official release of results on March 23, 2015. Please remark the three week turnaround time.

NEXT TEST INTERNATIONAL EVALUATION

The next test run for production, conformation, udder health, longevity, calving, female fertility and workability traits will take place in February 2015. Countries planning to introduce changes in their national evaluation procedures and wishing to have them included in the routine Interbull evaluation, should have their data examined in this test run. New data and validation results should be sent to the Interbull Centre no later than February 3, 2015, 17:00 CET.

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 minimizing the need to resort to conversions.

At the same time, all recipients of Interbull results are expected to honor 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 2014

Country	Date
CAN	20141201
DEU	20141202
DFS	20141102
ESP	20141118
GBR	20141101
ITA	20141106
NLD	20141201
POL	20141027
FRA	20141204

Table 2.

Number of bulls in reference population for hco

CAN	15398.0							
DEU	1267.0	21507.0						
DFS	1004.0	18964.0	19461.0					

Number of bulls in reference population for crc

CAN	21834.0							
DEU	1364.0	27608.0						
DFS	1094.0	24731.0	25485.0					
ESP	1173.0	24278.0	23648.0	25010.0				
GBR	20675.0	1216.0	959.0	1027.0	20730.0			
ITA	20096.0	1001.0	834.0	846.0	20012.0	20451.0		
NLD	1327.0	24741.0	24619.0	23750.0	1178.0	1032.0	26190.0	
POL	136.0	204.0	205.0	205.0	132.0	137.0	214.0	2629.0
FRA	1508.0	22572.0	21511.0	22179.0	1342.0	1100.0	21815.0	2461.0	26590.0

Number of bulls in reference population for cc1

CAN	21793.0						
DEU	1342.0	26118.0					
DFS	1093.0	23352.0	24023.0				
FRA	1508.0	21342.0	20357.0	25329.0			
GBR	20517.0	1193.0	958.0	1327.0	20601.0		
NLD	1322.0	23307.0	23157.0	20619.0	1168.0	24446.0	

Number of bulls in reference population for cc2

CAN	23533.0							
DEU	1328.0	27255.0						
DFS	1098.0	24760.0	25516.0					
ESP	1166.0	24102.0	23676.0	24835.0				
FRA	1490.0	22264.0	21540.0	21999.0	26243.0			
GBR	22313.0	1182.0	963.0	1022.0	1311.0	22362.0		
ITA	21591.0	996.0	838.0	846.0	1094.0	21511.0	21808.0	
NLD	1343.0	24685.0	24647.0	23765.0	21770.0	1188.0	1050.0	26308.0
POL	136.0	204.0	205.0	205.0	2456.0	132.0	137.0	214.0	2624.0

Number of bulls in reference population for int

CAN	23387.0						
DEU	1326.0	27226.0					
ESP	1165.0	24096.0	24828.0				
GBR	22242.0	1181.0	1022.0	22291.0			
ITA	21570.0	995.0	846.0	21493.0	21787.0		
NLD	1338.0	24679.0	23762.0	1186.0	1048.0	26270.0	
POL	136.0	204.0	205.0	132.0	137.0	214.0	2624.0