

FERTILITY INDICATORS

for the South African Jersey breed

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Globally, for many years, milk production traits carried more emphasis in the total merit indices for dairy cows. These traits are easy to measure and resulted in reliable and easily obtained genetic rankings. This led to significant improvements in milk and solid yields, but at the cost of fertility and longevity.

It is well known that profit in dairy herds is not just a function of output and product quality, but also expenses and losses. The selection pressure for higher production had deleterious effects on fertility resulting in lower profitability in dairy systems. This has led to a realisation that non-production traits must also be considered in selection

combined indices. Today the pendulum has swung in favour of fitness that is resulting in the weight on fertility in total merit indices to be as high as 25% in some countries. Within the South African National Information and Evaluation System (SAINET) for the South African Jersey breed, fertility carries a weighting of 15%.

INTERBULL values for female fertility

International genetic evaluations, carried out by INTERBULL in Sweden, estimate multiple across-country evaluation (MACE) breeding values for five fertility trait groups, i.e. maiden heifers' ability to conceive; lactating cows' ability to recycle after calving; lactating cows' ability to conceive (measured as a 'rate' trait); lactating cows' ability to conceive (measured as an interval trait); and for lactating cows', also the measurement of the interval from calving to conception. The best, and therefore most useful genetic correlations among the different participating countries, are for interval from first to last insemination, interval from first insemination to conception, non-return rate, interval from calving to first insemination, days open, and calving interval.

The genetic correlation for calving interval between South Africa and other countries varies from 0,70 – observed with Canada, Denmark–Finland–Sweden (DFS) and the Netherlands – to 0,83 with the United States. The genetic correlations among all countries participating in INTERBULL evaluations, ranges from 0,62 between New Zealand and

the Netherlands, to 0,84 between Canada and DFS. This is a particularly important indicator as reranking can be expected in all countries for international artificial insemination sires' performance for fertility traits. The sire ranking highest for fertility in the United States may therefore not be the top performer in South Africa or any of the other participating countries.

LogixSync

Since 2017, all cow and milk weights, as well as insemination information and pregnancy diagnoses from farm software programs are captured on the LogixSync functionality of SA Stud Book. On a weekly basis, this information is uploaded and incorporated into the official milk recording data on Logix, the central database of SA Stud Book. Researchers of SA Stud Book could therefore use the artificial insemination and pregnancy information for estimation of breeding values for fertility traits as recommended by INTERBULL. General statistics for these traits are indicated in Table 1.

Table 1 General statistics of fertility traits of the SA Jersey breed captured by LogixSync

	Min	Max	Avg	Modus	SD
AFI (days)	255	816	446,89	425	60,44
IFLI_h (days)	1	210	18,63	1,21	34,84
IFLI_c (days)	1	210	26,13	1,21	39,75
CtFI (days)	21	150	71,37	63	20,55
FItC_h (days)	260	460	295,72	281	31,09
FItC_c (days)	260	460	304,49	281	36,99
Days open (days)	23	360	98,49	69	46,11
Gestation length	260	310	281,08	281	5,97

(Min = lowest value, Max = highest value, Avg = average, SD = standard deviation)

Traits investigated were age at first insemination (AFI); interval from first to last insemination for heifers (IFLI_h); interval from first to last insemination for cows (IFLI_c); interval from calving to first insemination (CtFI); interval from first insemination to calving of heifers (FitC_h); interval from first insemination to calving of cows (FitC_c); days open (DO) and gestation length.

Environmental effects that significantly influenced these traits included herd, age

at calving, year and month of insemination, parity of the cow and sex of the calf (gestation length). Unfortunately, the identity of the inseminator and condition scores of the females were not recorded consistently enough for inclusion in the model.

In the following tables, the heritabilities and genetic correlations are indicated for fertility as traits of the heifer (Table 2) and cow (Table 3).

Table 2 Heritabilities ± standard error (on the diagonal) and genetic correlations ± standard error (above the diagonal) for fertility traits of SA Jersey heifers

HEIFERS	AFI	IFLI	FITC	NRR
AFI	0,379 ± 0,058	-0,522 ± 0,286	-0,039 ± 0,389	0,094 ± 0,382
IFLI		0,033 ± 0,016	0,848 ± 0,108	-0,020 ± 0,867
FITC			0,023 ± 0,012	-0,209 ± 0,726
NRR				0,029 ± 0,014

(AFI = age first insemination; IFLI = interval first to last insemination; FITC = first insemination to calving; NRR = non-return rate)

Table 3 Heritabilities ± standard error (on the diagonal) and genetic correlations ± standard error (above the diagonal) for fertility traits of SA Jersey cows

COWS	CtFI	IFLI	FITC	NRR	DO	GL
CtFI	0,033 ± 0,004	0,300 ± 0,020	0,164 ± 0,019	-0,458 ± 0,080	0,544 ± 0,017	-0,353 ± 0,039
IFLI		0,073 ± 0,003	0,990 ± 0,001	-0,515 ± 0,075	0,963 ± 0,005	0,730 ± 0,035
FITC			0,082 ± 0,004	-0,466 ± 0,077	0,917 ± 0,007	0,805 ± 0,028
NRR				0,0198 ± 0,003	-0,582 ± 0,072	-0,238 ± 0,097
DO					0,075 ± 0,003	0,543 ± 0,041
GL						0,0463 ± 0,004

(CtFI = calving to first insemination; IFLI = interval first to last insemination; FITC = first insemination to calving; NRR = non-return rate; DO = days open; GL = gestation length)

Except for age at first insemination, the heritabilities for the fertility traits are low, but well within the range of similar estimates published in the scientific literature.

Genetic correlations between the interval traits are moderately to highly positive, as can be expected. Non-return rate is negatively correlated to the interval traits, which is also expected, as longer intervals are genetically associated to lower non-return rates. Genetically higher ages at first insemination are associated with faster conceptions. Interestingly and possibly unexpected, a genetic tendency for a longer interval from calving to first insemination will favour animals with a genetic tendency for a shorter gestation length, while the tendency for longer intervals between first and last insemination and first insemination to calving will result in favouring animals with longer days open and longer gestation lengths.

In conclusion

Fertility in dairy cattle breeding is essential because it ensures regular calving, supports sustained lactations, reduces replacement and veterinary costs and improves lifetime productivity and profitability. Even though most fertility traits show low heritabilities, genetic improvement delivers large economic returns and contributes to greater herd sustainability. The capturing of artificial insemination and pregnancy diagnoses data from farm software via LogixSync enables the estimation of breeding values for the construction of an informative fertility index that will be incorporated in the SAINET in the future.

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