

## Developments in Dairy Cattle Evaluations – February 2003

### *Introduction.*

There have been substantial developments in dairy cattle evaluations over this last 12 months. These have included:

- Movement to Iris as the data source for genetic evaluations.
- Enhancements in genetic evaluations for milk production traits
- Enhancements in genetic evaluations for Calving Interval and Survival (CIS).

The following is a brief summary of these changes, together with a summary of the impact of these changes on bull proofs for milk production, CIS traits and EBI.

### *1. Movement to Iris as the data source for genetic evaluations.*

Genetic evaluations were first calculated from Iris in August 2002. Since then, considerable work has been carried out to ensure the integrity of data and pedigree information in the database. This was based on one to one matches between IDRC, HUKI, DAFRD and existing genetic evaluation data file to confirm that relevant records from each data source was in the database. Data not migrated (or incorrectly migrated) was added/updated to the database. This has had a substantial impact on the data included for genetic evaluations (see Tables 1 and 2). These data changes (for genetic evaluation) will continue until such times as all milk recording organisations are using Iris as the sole data for the provision of their milk recording service to farmers.

### *2. Enhancements in genetic evaluations for milk production traits.*

The enhancements have included:

- New/updated data for genetic evaluations
- New genetic evaluation software and genetic evaluation model
- Compliance with Interbull test guidelines
- Rescaling of Interbull proofs to Irish equivalent proofs (February 2003).

#### *(i) New/updated data for genetic evaluations.*

As a result of the 1:1 match work, some 382,000 lactations records (about 18% of the entire dataset) have been added to Iris over this last 6 months (Table 1). In addition, considerable work was carried out on correcting erroneous dates of birth (115,000 default dates of births were corrected) and sire mismatches (70,000 were matched to their correct progeny record).

*Table 1. Comparison of data and pedigree changes in genetic evaluation data for milk production traits (Feb 02 – Feb 03)*

	February 02	August 02	February 03	Diff (Aug 02-Feb03)
Number of lactation records	1,871,0	1,720,403	2,102,848	<b>382,445</b>
Number of cows	768,555	678,405	795,630	<b>118,225</b>
Number of sires	20,437	22,528	24,691	<b>2,163</b>

#### *(ii) New genetic evaluation software and genetic evaluation model.*

The current genetic evaluation model (and software) was first introduced in 1999. This model required that lactation data be pre-corrected for various environmental effects (i.e., age at calving, parity and calving interval), before the calculation of bull proofs. In such a scenario, any change in the data used for genetic evaluation could result in the pre-correction factors becoming

“inconsistent” with the dataset being analysed. Given the switch to Iris (and related changes in data source for genetic evaluations) a decision was taken to introduce new genetic evaluation software (provided by CR-Delta, Holland), which would allow the inclusion of all environmental factors directly in the genetic evaluation model.

In addition to introducing new genetic evaluation software a number of enhancements were made to the genetic evaluation model. These included:

- *Inclusion of year\*month of calving in the model as opposed to calving period.* The previous model had assumed a constant environmental effect over years. This is not always the case, e.g., an early spring in some years.
- *Day’s dry and days pregnant as opposed to calving interval.* The previous model had included calving interval as a “pseudo” for days dry and days pregnant. Inclusion of these two new effects in the model allows for more accurate estimation of the “true” effect.

*(iii) Compliance with Interbull guidelines.*

In the process of international genetic evaluation, data from participating countries is required to meet certain guidelines as outlined by Interbull. Problems with; (i) inappropriate correction factors, (ii) missing/incorrect data and (iii) genetic evaluation software, had resulted in Ireland failing these guidelines during the last 2 routine runs (August 02 and Nov 02). However, work completed during this last 3 months has ensured that Irish data is now acceptable for international evaluations, and as such will be included in the forthcoming Interbull test run for milk production traits (March 03).

*(iv) Rescaling of Interbull proofs to Irish equivalent proofs (February 2003).*

Interbull proofs are expressed relative to the most recent international evaluation for the participating country. In Ireland’s case, this was May 2002. Given, the substantial data and genetic evaluation model changes over this last 6 months, it was decided to rescale Interbull proofs for foreign sires (based on old model and old software) to Irish equivalent proofs for the latest evaluation run (Feb 03). This has ensured that proofs for foreign sires (those sires with <75 daughters in 50 herds in Ireland) are equally comparable with proofs for domestic bulls.

*3. Enhancements in genetic evaluations for Calving Interval and Survival (CIS) Traits.*

The enhancements have included:

- New/updated data for genetic evaluations
- Implementation of an Animal Model for CIS Traits.
- New genetic base for calving interval and survival.
- Development of new conversion equations for foreign sires.

*(i) New/updated data for genetic evaluations.*

The 1:1 match work outlined earlier has had a substantial impact on the data available for CIS evaluations. For example, the number of animals with SURV records has increased by some 282,000. The addition of this data has also impacted on the phenotypic means for each of the traits. For example, the inclusion of 98,872 record survival records from 1<sup>st</sup> to 2<sup>nd</sup> lactation has caused an increase in SURV by about 3.1%. Previously these animals would all have been assumed as culled or missing from the database.

Table 2. Comparison of data and pedigree changes in genetic evaluation data for calving interval and survival traits (Feb 02 – Feb 03)

	Feb 02		Feb 03		Difference in Records
	Records	Mean	Record	Mean	
Survival 1 <sup>st</sup> -2 <sup>nd</sup>	487,757	78.1%	586,629	81.2%	98,872
Survival 2 <sup>nd</sup> – 3 <sup>rd</sup>	386,144	78.2%	496,191	80.3%	110,047
Survival 3 <sup>rd</sup> – 4 <sup>th</sup>	296,109	76.2%	370,044	79.0%	73,935
CI 1 <sup>st</sup> – 2 <sup>nd</sup>	368,466	380.5 days	471,251	381.5 days	102,785
CI 2 <sup>nd</sup> – 3 <sup>rd</sup>	294,121	378.9 days	391,010	380.1 days	96,889
CI 3 <sup>rd</sup> – 4 <sup>th</sup>	220,501	377.6 days	287,417	378.4 days	66,916

*(ii) Implementation of an Animal Model for Calving Interval and Survival (CIS) traits.*

CIS proofs were first introduced in February 2001. These were based on first lactations only and were calculated using a sire model (i.e., only sires received proofs in the evaluation).

Developments in 2002 had focused on; (i) the inclusion of three lactations (as opposed to one) in the derivation of CI and SURV, (ii) the use of linear type and milk yield as predictors of CIS traits and (iii) the development of appropriate conversion equations for foreign sires.

Over this last 12 months further work has been carried out by Dr. Roel Veerkamp and his team at ID Lelystad, in conjunction with ICBF, on the introduction of an animal model evaluation for CIS traits for the Irish dairy industry. This work was completed in February 03, with some 960,00 animals included in the latest evaluation for CIS (using an animal model). This compares with some 40,000 animals in the previous sire model analysis.

*(iii) Genetic base for Calving Interval and Survival proofs.*

Given the substantial data and model changes, a new base was defined for Calving Interval and Survival. This was based on all progeny test sires born between 1988-1992 (135 sires). Base values were; (i) Calving Interval = -3.5 days and (ii) SURV = -0.30%, which were similar to the values defined previously.

*(iv) Development of new conversion equations for foreign sires.*

Given the substantial data and model changes, new conversion equations were estimated for those countries that; (i) export semen into Ireland, and (ii) have an equivalent CI/SURV proofs in their home country (i.e., Denmark, France, Netherlands, New Zealand, UK and the USA). As with last year, the procedure of “blending” foreign and domestic proofs was applied, for those sires that had daughters in both the foreign country and in Ireland (and where the reliability of the CIS proof in Ireland was < 50%). Those sires with no foreign proofs for CI/SURV related traits were given average values, based on the mean CI/SURV values for foreign sires imported into Ireland over the last 4 years (CI=+2.50 days and SURV=-0.40%).

A summary of data used in conversion equations (for each of the relevant countries) is given in Table 3.

Table 3. Summary of conversion equation information for six countries participating in ICBF conversion analysis.

Country	Irish Trait	Traits used in conversion equation	Correlation	Common bulls
Denmark	CIV	Fem_fert_idx + ebv_milk	0.94	25
	SURV	Long + angularity	0.99	
France	CIV	FER_proof + milk	0.44	35
	SURV	FER_proof + LGF_proof (longevity)	0.71	
NLD	CIV	Fertility_index + milk	0.90	45
	SURV	Du_with_predictors + fertility_index	0.76	
NZL	CIV	Fert_bv + ebv_milk	0.88	48
	SURV	Longevity_ebv + fert_bv	0.56	
UK	CIV	Prod + pta_lifespan	0.66	55
	SURV	Pta_lifespan	0.64	
USA	CIV	Prod pta_preg_rate	0.66	35
	SURV	Direct_long + udder depth	0.66	

#### 4. Impact of changes on bull proofs for milk production, CIS and EBI proofs.

The substantial data changes and model enhancements over the course of the last 6 months have had some impact on bull proofs. These are outlined in Table 3.

Table 4. Milk production, calving interval and survival proofs for proven bulls (based on 788 AI sires, with a minimum CIS reliability of 50%).

	Mean-Feb 02	Mean-Feb 03	SD-Feb02	SD-Feb 03	r-Feb 02/03*
Milk kg	171	194	227	232	0.99
Fat kg	4.4	6.4	6.8	7.1	0.97
Protein kg	4.2	5.8	5.9	6.4	0.97
CI days	0.74	0.90	2.8	3.2	0.93
Surv%	-0.20	-0.8	1.1	1.5	0.68
EBI (€)	11.5	12.5	25.6	25.7	0.90

\*Correlations are based on 190 AI sires with reliable production, CIS proofs and EBI proofs (average reliability of proofs for EBI=95%).

##### (i) Milk production proofs.

Variation in milk production proofs (milk, fat and protein yield) has increased slightly, suggesting that the new model is correcting for more non-genetic effects than was corrected for previously. This change can be seen in the production proofs for top sires, which have, in general, increased by about 1-5%.

The correlation between proofs (Feb 02-Feb 03) for milk, fat and protein yield are also very high (>0.97) indicating very little re-ranking of sires for these traits (see Table 1). These results suggest that the model changes and substantial data changes have had a minimal impact on the ranking of sires for milk production traits.

##### (ii) Calving Interval and Survival proofs.

The move to an animal model evaluation for CIS traits has had a considerable impact on the variation in proofs for CI and SURV. Again, this can be accounted for by better estimation of

genetic and non-genetic effects (particularly that of selective mating of sires), as a consequence of having access too much more information.

The correlation between proofs (Feb 02-Feb 03) is high for Calving Interval ( $r=0.93$ ) but somewhat lower for Survival ( $r=0.68$ ). The lower than expected correlation for Survival can be explained by;

- *Lower heritability for SURV* – the heritability of SURV is about 1%, compared to about 4% for CI traits (and 35% for milk traits). As a consequence any data or model changes are going to have a much larger impact on SURV than on any other trait.
- *Selective mating of sires* - Sire model evaluations assume that bulls are used randomly across the National herd. This is not always the case, and very often high profile bulls are mated to cows with above average genetic merit for milk production. This could have had the effect of “biasing” down CI and SURV proofs for these bulls in the past (correlation between milk production and CIS is negative), unless some correction is made for the genetic merit of the mate.
- *Data changes* – The increase in number of SURV records between May 02 and Feb 03 (some 280,000 records) has had a notable impact on mean Survival (increased by about 3%). Previously these records would have been assumed to be missing or even culled. A high proportion of these records would also have been from pedigree herds (as a consequence of the IHFA tidy-up), which could cause some changes in bull proofs, for those bulls used heavily in pedigree herds.

*(iii) EBI proofs.*

Overall EBI values have increased slightly between Feb 02 and Feb 03. Variation in EBI has also increased, reflecting the changes in variance for milk production and CIS proofs. Correlations in bull proofs are about 0.90, indicating some level of re-ranking between proofs for common sires (between Feb 02 and Feb 03).

*Conclusion.*

- Substantial data improvements in Iris have resulted in more (and better) information being available for genetic evaluations.
- Enhancements in milk production evaluations have resulted; (i) more accurate evaluations for milk, fat and protein yield (as evidenced by the increase in variation of proofs) and (ii) compliance with Interbull guidelines for international evaluations.
- Enhancements in CIS evaluations have resulted in; (i) access to CIS proofs for cows, (ii) more accurate evaluations for CI and SURV proofs (as evidenced by the increase in variation of proofs) and (iii) some re-ranking of sires for SURV. However, these are to be expected given the nature of this trait and the substantial data and model changes for SURV.