
The impact of new technologies on performance recording and genetic evaluation of dairy and beef cattle in Ireland

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New technologies in performance recording have played a critical role in helping develop Irish dairy and beef cattle breeding programs. Fundamental to this has been the establishment of the central cattle breeding database, which allows ICBF quickly expand into new technological opportunities, e.g., EDIY milk recording, Handheld technology and Image data from abattoirs. In addition, a strong emphasis is placed on business partnerships, where the overall goal is to “add value” to information collected on Irish cattle, by linking together systems from across the industry, e.g., marts and abattoirs. The end result of these improvements has been a substantial increase in the quantity and quality of data available for cattle breeding, resulting in increased profitability for Irish farmers and the dairy and beef industries.

Key words: performance recording, EDIY milk recording, Handheld technology, Carcass image data, Weanling performance, Business partnerships.

Irish Cattle Breeding Federation (ICBF) commenced operations in 1998, with the objective of achieving the greatest possible genetic improvement in the national cattle herd for the benefit of Irish farmers, the dairy and beef industries and members.

Since its inception, much of ICBF’s work has been focused on improving the quantity and quality of data available for cattle breeding. New technologies have been tapped into and business arrangements established (with both shareholders and industry stakeholders alike), with the overall goal of ensuring that Irish farmers have access to high quality information on which to breed more profitable cattle.

In this paper we identify some of the major data recording developments over the past 10 years, with particular emphasis on “new technologies” for performance recording. These have included;

1. The ICBF Central Cattle Breeding Database.
2. EDIY Milk Recording.

Summary

Introduction

3. Handheld Technology (AI, linear scoring/ weight recording and lameness).
4. Carcass image data (from abattoirs).
5. Weanling performance data (from "Farmers Marts").
6. Web-based recording systems.

In addition, we will discuss the importance of developing strong business partnerships with shareholders and industry stakeholders, as well as give some insights into futures plans for performance recording in Ireland.

The ICBF cattle breeding database

Cattle breeding data in Ireland is recorded in two main databases:

1. The CMMS database (Centralised Movement and Monitoring System) as operated by the Department of Agriculture (DAF) in accordance with relevant EU regulations for animal traceability (www.agriculture.gov.ie).
2. The ICBF Cattle Breeding Database, as operated by the Irish Cattle Breeding Federation on behalf Irish dairy and beef farmers and the wider cattle breeding industry (www.icbf.com). Both databases operate in complete synchrony. This is a major plus for Irish farmers and the cattle breeding industry as information must only be provided once, with data flows allowing data to be shared between all relevant stakeholders.

The ICBF database has been fully operational for dairy, beef, milk recording, beef performance recording, genetic evaluations and herd books since 2005. Some 30 000 herds, with 1.1 million calvings (representing half of the Irish cattle herd) were participating in one or more aspects of the database by the end of 2007 (Table 1). Indeed, the number of herds involved in the ICBF database has more than doubled in the past few months (over 60 000 herds are now involved), with the launch of the new "Animal Welfare, Recording and Breeding Scheme for Suckler Cows" by DAF and the Irish beef industry. A key component of this scheme is the recording of all relevant "Animal Events" data through the ICBF cattle breeding database.

Looking at trends in data recording over the past 6 years (Table 1), indicates a dramatic increase in the quantity and quality of data available for cattle breeding as result of the establishment of the central database. For example the number calving performance events recorded in 2001 (via the National AI progeny test program) was 18 183, compared to 478 234 in 2007, a factor increase of 26.3 times. Similar trends are apparent for other traits, most notably slaughter records, which have increased by a factor of 300 times. Historically these records (including data for milk recording, linear scoring and weight recording) were collected as part of the services provided to Irish farmers through the National progeny test program and/or herdbook/milk recording services. Each of these services had their own separate system resulting in much duplication by farmers and the industry. The establishment of the ICBF database has removed this duplication, at farm level. In addition, the establishment of the shared linkage for CMMS data (with DAF), has resulted in a cattle breeding system that can deliver high levels of quality data for genetic improvement of dairy and beef animals in Ireland.

EDIY milk recording

The level of milk recording in Ireland is somewhat lower than in other developed dairy countries (typically 30% of cows are recorded in Ireland compared to >50% in countries such as UK, Netherlands and the Nordic countries; ICAR, 2008). In an attempt to address these low levels of performance recording, a new milk recording service (EDIY milk recording using the Tru Test electronic meter) was launched to

Table 1. A comparison of the level of performance recording in Ireland (2001 vs. 2007).

Data flows	2001 ¹	2007	Relative increase
Department of Agriculture (DAF)			
- CMMS Births	0	1 111 569	New data
- Slaughter records	2 450	756 911	308.9
ICBF Animal Events/HerdPlus			
- Animal Event Births	0	606 326	New data
- Pedigree birth registrations	85 416	87 832	1.03
- Calving performance	18 183	478 234	26.3
- DIY AI serves	0	156 651	New data
- On-farm linear scoring	9 809	14 362	1.46
- On-farm weight recording	6 039	7 863	1.30
- Farmer mart weight recording	0	159 231	New data
Herdbooks			
- Dairy linear scoring	15 386	23 329	1.52
Milk Recording Organisations			
- Milk recording	336 868	428 170	1.27
AI Companies			
- Technician serves	18 183	498 073	18.8

¹Data recorded via AI progeny test, herdbook& milk recording systems.

dairy farmers in 2006 (after an initial 2-year trial period). Response to the new service has been very positive amongst farmers and industry alike with the percent of cows in milk recording now approaching 40% (Table 2). Furthermore, of the 428,179 cows in milk recording in 2007, some 28% of these were recorded using EDIY, which reflects the value placed in this new service. Recent feedback from farmers and the industry has indicated that the key benefits of the new service have been:

1. A reliable technology (i.e., durable and easy to use).
2. A reduction in cost (due to removal of paper recording and an electronic link to the ICBF database).
3. Better integration between the ICBF database and laboratory systems.

ICBF anticipates rolling additional EDIY cells (currently there are some 20 cells in operation throughout Ireland), over the coming years, with a 5-year goal of having 60% cows in milk recording by 2013.

Table 2. Trends in EDIY milk recording (2004-2007).

	2004	2005	2006	2007
Total dairy cows	1 121 000	1 101 000	1 087 100	1 079 800
Cows in milk recording	381 425	380 196	408 375	428 179
Percent total dairy cows	34.0	34.5	37.6	39.7
Cows in EDIY milk recording	7 231	30198	99562	119890
Percent milk recorded cows in EDIY	1.9	7.9	24.4	28.0

Handheld technology

Handheld technologies are currently being used in 3 areas of ICBF's performance recording business:

1. Technician recording of Artificial Insemination data.
2. Technician recording of linear score and weight recording data on farms.
3. Technician recording of lameness data. Each of these technologies is based on the principle of electronic data capture of performance data and then transfer of this data to the central database via GPRS technology.

Technician recording of AI data

There has been a major increase in the level of insemination data recorded in the ICBF database over the past 3 years (Table 3). The main "driver" of this growth has been the introduction of AI handhelds, which are used by technicians, to record AI data on farms. This technology allows the AI technician link directly to the ICBF cattle breeding database (via GPRS), ensuring fast and accurate recording of insemination data on each individual dam (and sire). In addition to providing information for cattle breeding purposes, i.e., the genetic evaluation of gestation length, the new handheld technology also allows ICBF and AI service providers provide many more services to end-users, including:

1. Inbreeding and lethal gene checks.
2. Sire advice options for farmers.
3. Fertility management reports for farmers and AI service providers.
4. Better semen invoicing and stock control for AI service providers.

Linear scoring and weight recording data

Technician recording of beef linear score and weight recording data was first introduced in 2006. Prior to this date, data was manually recorded and keyed into the database for subsequent reporting and genetic evaluations. The technology used is the same as that for the AI handhelds, with adaptations of the software to cover the range of beef linear and weight recording traits. Some 14 362 beef linear scores and 7 863 weight records were collected via these handheld in 2007 by a total of 8 regionally based technicians. A further adaptation of the software to cover dairy linear scoring has just been completed and tested and is currently being rolled out by Irish Holstein Frisian Association as part of its services to members and to the dairy breeding industry.

Lameness data

In addition to the above traits, work has also been completed on the collection of lameness data on commercial dairy farms by Farm Relief Services (FRS). Again the existing handheld technology will be used, with adaptations to cover the range of lameness traits. Whilst this work is still at trial period it is hoped that that, in the future, the handhelds will become a routine part of the "hoof-care" business, thereby providing ICBF with valuable lameness data, as well as covering the administrative requirements of FRS.

Table 3. Trends in recording of insemination data.

	2005	2006	2007
Technician AI	213 719	291 081	498 073
DIY AI	91 396	137 046	156 651
Total AI	305 115	428 127	654 724

In addition to collecting beef performance data on live animals (e.g., linear score and weight recording data – see above), ICBF also has access to high volumes of carcass data, through its relationship with DAF and the abattoirs (a total of 756 000 records were collected from abattoirs in 2007 – Table 1). This data is reported to DAF (by the abattoirs) for the purpose of EU price reporting and a copy then forwarded onto ICBF (by DAF) for purpose of genetic improvement of carcass traits. The carcass traits received from DAF includes:

1. Cold carcass weight.
2. EUROP scale for conformation and fat score (on a 1-15 basis), with the data then being stored in the cattle breeding database for the provision of breeding and management data for Irish beef farmers.

The latter data (the EUROP scores) is of special interest as it is derived from images collected and stored within the carcass grading machines, rather than from subjective classification by an inspector. ICBF are currently working with Teagasc and the providers of the carcass grading machines to extend the predictive ability of the software to cover carcass cut data, in addition to EUROP grade and score. This would be a major step forward for the Irish beef industry as it would give Irish beef farmer's access to information on the bulls and cows which are breeding animals with high weights (kg) of high value cuts. Initial work in this area (based on dissected data collected in a commercial abattoir) is very positive and indicates significant variation in these traits (Table 4)

Table 4. Genetic parameters for Carcass Cut Data (Pabiou, 2008)¹.

	Carcass kg	Sirloin kg	Fillet kg
Carcass kg	0.59 (0.20)	0.62	0.75
Sirloin kg		0.55 (0.20)	0.75
Fillet kg			0.62 (0.20)

¹Heritabilities on the diagonal and genetic correlation above the diagonal.

A further novel aspect of beef recording systems in Ireland is the presence of farmers marts. There are some 70 marts across the country, trading over 2 million animals per year (usually between the breeder of the animal and owner for subsequent "finishing" to slaughter). A significant "added value" to this activity is the electronic capture of weight and price data. Recent work by ICBF has indicated that there is a high value to this type of information, especially where the sire is known and the weanlings (150-300 days) are being sold as singles, and alongside cohorts from the same herd. Although the loss of data is large (for example of the 159 231 records retrieved from marts in 2007, less than 10 000 made it into genetic evaluations for direct weaning weight), ICBF expects this to become a valuable source of data in the future, due to the advent of the new Suckler Cow Welfare Scheme (referred to earlier) and the introduction of improved recording and reporting technologies within the mart systems.

In addition to significant improvements in field recording of performance data, ICBF has also invested considerable effort and resources into web-based systems for data recording by farmers. A good example of this is insemination data, where opportunities to record AI data by farmers has resulted in a further 41 345 insemination records being recorded in the ICBF database in 2007. Other

Carcass image data (from abattoirs)

Weanling performance data (from farmers marts)

Web-based systems of data capture

traits are now included in the data capture system, e.g., weights and animal health traits. However, success in web-based systems for recording performance data is dependent on having valuable management information to help promote the benefits of farmer recording. Without good reports, Irish farmers will see little tangible benefit in recording this data.

The benefits of business partnerships

One of the major reasons behind ICBF's success in delivering more data for cattle breeding has been the shared vision that exists within the Irish cattle industry (both shareholders and stakeholders alike) regarding the value of cattle breeding. Complicit in this has been the unique relationship which ICBF shares with the DAF, thus ensuring minimal duplication in data for cattle breeding and maximum "value-add" for Irish farmers and the dairy and beef industries. Many other synergies exist between ICBF and its shareholders and industry stakeholders with a "win-win" approach adopted by ICBF and the relevant business partner (Table 5). In each of the examples, the "win" for ICBF is in getting access to a "new trait" of economic importance for Irish farmers, whilst the "win" for the business partner is usually an improvement in efficiency as a result of using the database to provide services to end-users.

The above partnerships do not include data recorded directly by farmers, or data recorded by ICBF technicians (linear scoring and weight recording of beef cattle). In addition to the above business partnerships, ICBF and the Irish cattle industry are also exploring options for using the cattle breeding database in the provision of "Herd Health" services to farmers, with the database then being used by veterinary practitioners for the routine recording of all relevant events and treatments on cattle farms.

Impact on genetic evaluation of cattle in Ireland

The net effect of the above arrangements, coupled with the establishment of the central cattle breeding database and the use of new technology outlined earlier, has been a dramatic increase in the quantity and quality of data available for cattle breeding (Table 1). At this stage, ICBF produces genetic evaluations for some 60 traits, across dairy and beef cattle. These are generated 4 times per year, January, May and August (coinciding with the Interbull dairy runs) and one additional run in November (for dairy and beef cattle). All evaluations are carried out on an across breed basis, allowing dairy and beef farmers the opportunity to select bulls and cows on both a within and across breed basis. Whilst all of the data for each genetic evaluation run is stored in the central cattle breeding database, significant time is required to extract, calculate and then "re-load" proofs for all traits and all animals (including parent averages) back into the database (including the computation economic indexes for an additional 7 traits). Currently the entire process takes some 6 weeks. We are currently examining ways at reducing this time, with the overall goal of having it reduced to 3 weeks.

The across breed nature of ICBF's genetic evaluation systems can perhaps be best appreciated by an examination of Euro-Star proofs for the various breeds present in Ireland (Figure 1). A total of 12 breeds are evaluated, using both pedigree and cross-bred data. The Euro-Star indexes were first made available to Irish farmers in March 2007, and have been very well received (ICBF Annual Report, 2007). The fact that the evaluations exhibit substantial variation on both an across and within

Table 5. Summary of key business partnerships with the Irish dairy and beef industries.

Business partner (including status).	Key data provided	Traits evaluated (based on data)	Benefit for the business partner
DAF (stakeholder)	<ul style="list-style-type: none"> • Birth registrations, cattle movements and deaths 	<ul style="list-style-type: none"> • Calving Interval (Days), Survival (1st-4th Parity) 	<ul style="list-style-type: none"> • Improving the profitability of Irish dairy and beef farmers and industry
AI Organisations (ICBF shareholder)	<ul style="list-style-type: none"> • Insemination records 	<ul style="list-style-type: none"> • Gestation length, male and female fertility traits 	<ul style="list-style-type: none"> • Use of database to provide service to users • Greater control of AI business • Real-time recording of data • No paperwork, better accuracy and efficiency
Milk recording organisations (ICBF shareholder)	<ul style="list-style-type: none"> • Milk performance records 	<ul style="list-style-type: none"> • Mkg, Fkg, Pkg, F%, P%, SCC 	<ul style="list-style-type: none"> • Use of database to provide service to users • Greater efficiency • New and improved reports for farmers
Herdbooks (ICBF shareholder)	<ul style="list-style-type: none"> • Dairy linear type 	<ul style="list-style-type: none"> • Linear type traits, including body, mammary, feet/legs and overall 	<ul style="list-style-type: none"> • Use of database to provide service to users • Greater efficiency • Real-time recording of data
Abattoirs (Stakeholder)	<ul style="list-style-type: none"> • Carcass data and price/kg 	<ul style="list-style-type: none"> • Carcass weight, conformation grade, fat score • In the future carcass cut data 	<ul style="list-style-type: none"> • Improving the profitability of Irish dairy and beef farmers and industry • Options for “procurement” service being explored
Farmer marts (Stakeholder)	<ul style="list-style-type: none"> • Weight data and price/kg (indicator of quality) 	<ul style="list-style-type: none"> • Weaning weight (direct and maternal), Weanling Calf Quality (150 - 300 days) and “Drop calf quality (0-30 days) 	<ul style="list-style-type: none"> • Improving the profitability of Irish dairy and beef farmers and industry • Options for “on-line” catalogue services being explored
Teagasc (Stakeholder)	<ul style="list-style-type: none"> • Research data 	<ul style="list-style-type: none"> • Range of traits “for the future” including; farmer opinion, lameness, carcass cut data, feed intake/efficiency 	<ul style="list-style-type: none"> • Use of database to build programs (staff and systems) that will increase the future profitability of Irish dairy and beef farmers and industry

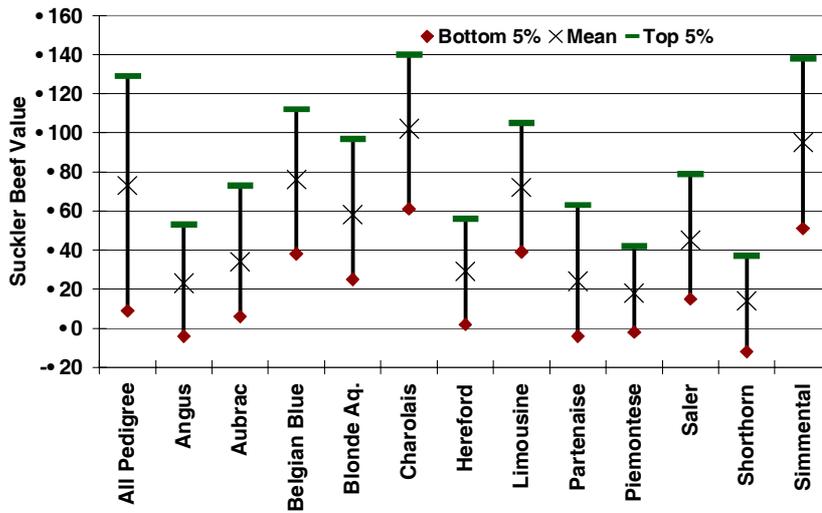


Figure 1. Ranges by breed of uro-Star suckler beef value.

breed basis (typically about 100/calf born in PTA terms) is very positive and demonstrates the benefits of adopting a multi-breed evaluation approach to our cattle improvement systems.

Whilst the uro-Star indexes are relatively new to Irish farmers and the Irish beef industry the dairy Economic Index (EBI), has been in place for a number of years. First launched in February 2002 (ICBF Annual Report, 2007), the index combines information on milk solids (~40% weighting), female fertility traits (~40% weighting) and calving, beef and health traits (~20% weighting). The overall response from farmers and the industry to the index has been hugely positive, as can be demonstrated from a plot of genetic trend for EBI over the past 30 years. Since its

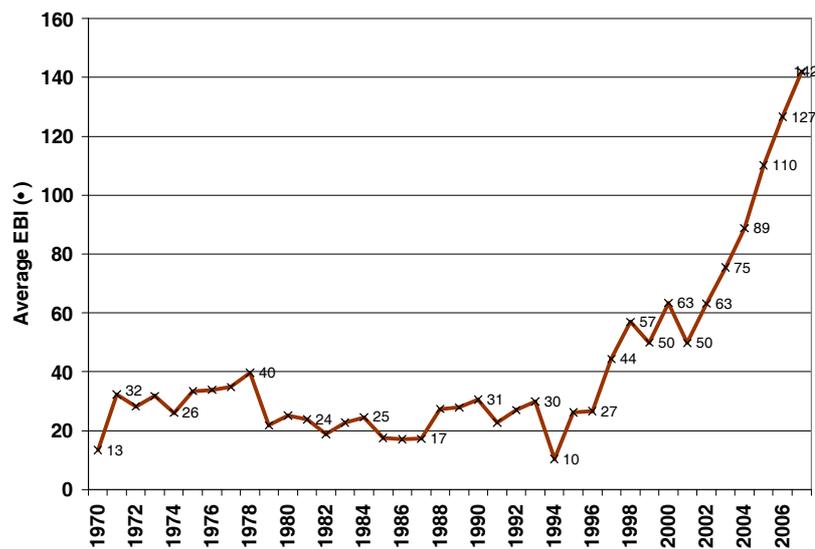


Figure 2. Trend in average EBI of Holstein Friesian bulls registered for use in AI, by year of birth.

inception in 2002, EBI has increased by about 15/year, based on sires being registered for AI use. Our goals over the next few years is to continue this increase and to achieve similar increases within the beef Euro-Star index.

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