Establishing a Shared Cattle Breeding Database – Recent Experiences in Ireland

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Summary

Over the last six years a shared cattle breeding database has been established in Ireland. This database is now being used to meet the information needs of herd books, milk recording, artificial insemination and genetic evaluation for beef and dairy cattle. Development of this database required the establishment of a new information technology infrastructure and migration of historical data from some 40 legacy systems. Recording effort required of farmers has been both reduced and simplified. Complexity and turnaround times of genetic evaluation systems were substantially reduced. Establishing an integrated database required a large effort and the negotiation of data and information sharing protocols involving many organisations but the benefits to Irish cattle farmers through more useful breeding and management information more than justified the cost.

Keywords: database, genetic evaluation, herdbook, milk recording, artificial insemination

Introduction

The Irish Cattle Breeding Federation Society Limited (ICBF) was formed in July 2000. Its formation was the culmination a long series of negotiations following the creation of an interim Board in 1997 and the appointment of a Chief Executive in 1998. ICBF is owned by the organisations that make up the cattle breeding industry in Ireland with 46% of shares held by farmers unions, 18% by herd books, 18% by milk recording organisations and 18% by artificial insemination cooperatives. ICBF's Board of sixteen directors are appointed for four-year terms by shareholders; six by farmers unions, three by herd books, three by milk recording organisations and three by artificial insemination co-operatives and one by the Department of Agriculture and Food (DAF). ICBF is funded by a combination of DAF grants, a payment on all ear tag sales and service fees. It has also received capital grants from EU Structural Funds and more recently from Ireland's National Development Plan.

ICBF's mission is "*to achieve the greatest possible genetic improvement in the national cattle herd for the benefit of Irish Farmers, and the Dairy and Beef industries and Members…*". To this end the focus of its activities is on the three main elements of genetic improvement; data, genetic evaluation and breeding scheme design. This paper deals with the data element of ICBF's breeding strategy.

Background

Historically, Irish cattle breeding data was held in some 40 specific purpose databases with a variety of systems providing links between them. In the case of dairy cattle breeding data the main databases were those for:

- **milk recording -** comprising nine regionally based computer systems,
- **herd books -** which for the dominant dairy breed the Holstein-Friesian was part of a UK based system servicing the UK and Ireland,
- **artificial insemination** - comprising eight systems operated by regional co-operatives,
- **genetic evaluation -** operated by DAF, and the
- **official calf registration** - operated by DAF through a series of contracts with agricultural cooperatives.

Each of these databases had evolved a number of different forms of animal identification. For Holstein-Friesians 19 different forms of animal identification existed.

During the formation of ICBF a services terms and conditions agreement was negotiated with the owners of existing databases. This agreement addressed issues associated with the creation of the shared database including data ownership, data access, fees & charges, communication and the relationship between ICBF, its members and herd owners.

Database Strategy

ICBF's strategy was to establish a single shared database to meet the information needs of the Irish cattle breeding industry. The main elements required are listed here and described in greater detail below.

Information Technology Infrastructure

Hewlett Packard L class servers using the UNIX operating system were selected through a tendering process to run the central database. Initially one server was used for development and this has now been increased to three with one for production, one for "hot" backup located in a different building and one for development. These servers are linked by wide-area network to 30 service providers at remote sites using a combination of leased and dial-up ISDN lines. ICBF's head office, development team and genetic evaluation unit are located on a local area network that includes the database servers.

CR Delta's IRIS package, based on an Oracle database, was selected in 1999 after a review (Greally et al, 2000) that considered the options available. The core functions of IRIS are developed and maintained by CR Delta while a small development team of contractors and staff (currently eight people) located in ICBF is responsible for customisation to meet specific Irish needs, to handle data migration issues and to develop reports for use in Ireland.

Streamserve^{TM} is used for reporting – both on paper and electronically as Adobe Acrobat PDF^{TM} files. ICBF has developed an in-house capability to build reports specifically for use in Ireland.

Data Migration

Data migration proved to be a much more time consuming and complex task than originally estimated. With data spread over some 40 historical databases all of which had evolved over periods of many years the knowledge required to design the migration schemes did not exist. Consequently, a great deal of trial-and-error was required before all inconsistencies could be resolved. The process required reference back to individual farmers to resolve some animal identification problems.

For milk recording a parallel processing strategy was adopted at an organisational level with herds switched from old to new systems on a recorder-by-recorder basis. This provided the time required for identification and duplicate record issues to be resolved for each herd before processing commenced under the new system. A period of some 18 months was required to change all 7,000 herds over to the new system.

Data Recording

ICBF's Animal Events data recording system was established to provide a system for farmers to provide the data required to meet the needs of herd books, milk recording and DAF's official calf registration. This system provides farmers with the choice of paper based recording that is used by some 83% of herds or an electronic system supported by four commercially available personal computer based recording packages.

The Animal Events system is used by both beef and dairy herds and facilitates the collection of data on identification, ancestry, pedigree registration, calving survey, liveweights, artificial inseminations conducted by the farmer, natural matings, drying-off, weaning and disease diagnosis.

DAF Interfaces

DAF interfaces provide ICBF's cattle breeding database with electronic copies of calf registration data, animal movements and slaughter records for all herds participating in cattle breeding activities. Data protection issues are dealt with by each farmer providing a signed instruction to DAF for their data to be released to ICBF for cattle breeding purposes.

Artificial Insemination Interface

The AI interface enables files of technician-recorded inseminations to be loaded periodically..

Genetic Evaluation Interfaces

By consolidating all data required for genetic evaluations into a single database a large and complex genetic evaluation system, involving several hundred programs was eliminated and replaced by data extracts and database updates. All the information required for the publication of genetic evaluations is held in the database and relatively simple extracts are all that is required to support this activity.

The change-over period for dairy genetic evaluations proved to be particularly trouble-some as there had been many data "corrections" made during the migration process while at the same time the genetic evaluation models were being updated. It proved to be difficult to rationalise changes in evaluations that occurred over this period. Only by repeating the evaluation computations "before" and "after" data migration using the same evaluation model and comparing the results were all remaining issues resolved.

Farmer Reports

Reports provided to farmers as part of milk recording and herd book services have been totally redeveloped. The database enables a wider range of information to be included in reports and thus increases their value to farmers. For example milk recording reports draw on identification, ancestry, herd book registration, animal movement, genetic evaluations, disease diagnosis as well as the usual milk yields, milk compositions and lactation yield computations.

Streamserve[TM] has been used to facilitate the printing of reports in a single sequential printer output for posting to each farmer. This mechanism has eliminated the need for collating printed output prior to posting.

A generic PC download has been developed to enable farm computer systems to be initially populated and to be updated with new milk recording, genetic evaluation and related data.

Management Reports

A series of management reports for use by staff in service providing organisations were developed and made accessible through web browsers via an intranet site. These reports are created either on demand or according to an agreed schedule and are available in MS Excel and HTML formats.

Results

ICBF's cattle breeding database is now fully operational including:
- Animal Events recording for some 13,000 beef and dairy herds,

- Movement notifications from DAF systems with some 250,000 in the first three months of 2004,
- Dairy genetic evaluations for production, linear and fertility traits processed four time per year,
- Beef genetic evaluations for three traits being computed weekly for three beef breeds to incorporate linear scores recorded in the preceding week,
- Pedigree herd book registration and is currently supporting 12 beef and dairy herd books with over 90,000 Holstein Friesian registration in 2003 (a 50% increase over 2002),
- Milk recording for some 7,000 herds with 1,200 herds being processed per week, and including some 375,000 milk recorded cows, and
- Linear scoring for both beef and dairy traits with 12,000 and 20,000 inspections processed respectively in the last 12 months.

Comprehensive statistics are now available for Irish Cattle breeding and are published routinely (Irish Cattle Breeding Federation, 2003).

Conclusions

A single integrated cattle breeding database has been established for Ireland to support the information requirements of herd books, milk recording, genetic evaluation and artificial insemination. Standardised permanent and long term unique identification of individual animals would greatly simplify the establishment of cattle breeding databases.

A prerequisite to the establishment of a shared database are agreements to share data and facilities. The establishment of a new organisation (ICBF) provided a mechanism for creating this agreement. With stable funding and a shared vision the many problems associated with creating a shared cattle breeding database were overcome and a new era in Irish cattle breeding ushered in.

ICBF's national cattle breeding database greatly facilitates the provision of breeding and management information services to cattle farmers.

References

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