RECORDING IN DAIRY CATTLE IMPROVEMENT

F.V. Badham

Department of Agriculture, Victoria

Methods of recording, storage, analysis and retrieval of dairy cattle data should be determined by the scale of operation, the objectives to be achieved (managerial or genetic) and the range of people and organizations requiring access to the stored data.

Most dairy cattle data are directly applicable to a sufficiently large population and are sufficiently useful to justify considerable expenditure on development of computer systems. Pearson (1978) lists the following advantages of computerized records:

a) a shorter time to complete many processes;

b) opportunity for data analysis that would have previously been impossible with manual processing;

c) after program development, reduction in the cost of a given job;

d) a reduction of recording errors due to hand-copying, and the elimination of some proof reading;

e) machine screening or editing of records to determine data which should be checked for errors, increasing the efficiency of manual checking; and

f) work is less monotonous and therefore more productive.

EXISTING OR POTENTIAL PERFORMANCE RECORDING SYSTEMS

Ultimately all dairy cattle data should be considered as part of one large information pool, but because of differences in, for example, frequency of collection, reasons for collection, analysis requirements and even industry politics, various data groups have been identified separately and will therefore be discussed as such. In some cases the same data are required in more than one system which has led to duplication of data collection. Comment is made later on data transfer potential between systems.

1. Herd Recording

Production recording is traditionally one of the oldest and numerically the strongest dairy cattle data recording systems in Australia. All States now have computer-based systems with varying degrees of sophistication in data entry, analysis and reporting.

All systems revolve around a monthly assessment of daily yield from which lactation yields and, in some States, production and breeding indexes are developed. All systems collect and store data relating to the pedigree, breed and birth date, ownership and location of the animal and issue monthly (lactation-to-date) and annual reports to participants. Some States collect and analyse other data, such as somatic cell counts, for part or all of the

recorded population.

No effort has been made to develop standards of system or file design, identification methods, the precision or nature of stored data or the content of reports issued by the systems. Only comparatively recently has a national system of A.B. sire identification been considered seriously. All systems operate satisfactorily.

Considerable interstate communication now occurs on current developments, but existing systems have been developed at considerable cost and expensive duplication of effort has occurred. This can be partly justified because of different requirements or computers and to date data transfer between State systems has been minimal. Lack of uniformity will contribute significantly to development costs of centrally-based systems, such as those used for national cow and bull indexing.

Some systems prepare sire assessments based on progeny test information. The first steps toward common analysis and expression of sire indexes have recently been taken through the submission of each State's data to the Victorian R.B.V. system of analysis.

2. Breed Society Records

All breed societies maintain herd books for registered animals, recording pedigree, ownership and classification information. With one exception all are manually operated and are therefore either expensive to maintain or inefficient in data presentation or analysis.

A feasibility study is presently assessing strategies for computerising this data, considering the requirements of individual breed societies, development costs and design aspects required to exchange data with existing State production recording systems and the proposed N.D.H.I.S. bull and cow indexing system.

Each breed society has individual methods of animal identification common to no other identification system.

3. Mating Data

Systems of collection, recording and analysis of premating heat dates, mating date, bull and, if an A.I. mating, the semen batch and inseminator, have been developed and are available. Such systems provide farmers with management aids like expected calving order, pasture management and heat detection data, and provide general industry and A.B. statistics on non-return rates. They also have the potential to provide parentage and calving date verification for other data collection systems such as herd recording, and accounts management for insemination centres.

Many uses of such data are still being explored but will certainly become a powerful information source. However its development poses interesting problems:

- one feasible method of collection is in conjunction with production records, but what consideration should be given to non-recorded cows and multiple input requirement (oestrus cycle being less than monthly);

- if the system is to provide current mating information to the farmer then a monthly return may not be sufficiently frequent, but if the analysis need only be historic, then it could be feasible to collect all data at the end of the breeding season;

- if analysis is required more often than monthly then it could be regionalised or collected in conjunction with other systems, such as herd health, with data flowing on a regular basis to a central bank for industry statistics;

- for A.B. data, are individual insemination records a suitable data alternative, and if so, what consideration should be given to do-it-yourself inseminations?

4. Herd Health Data

Schemes based on regular collection of herd health data and the issue of reports relating to the reproductive and disease status of dairy dattle have been operating, at least on a pilot basis, for some time. The University of Melbourne has based such a scheme on the receipt of data from farmers, who use diaries to record daily events, such as heats, matings, calvings, disease conditions and treatments, and on reports from veterinarians on pregnancy diagnoses and veterinary treatment. Farmers receive reports on various aspects of fertility and disease and recommendations on expected calvings, cows to cull and cows requiring veterinary inspection.

5. N.D.H.I.S. Bull and Cow Indexing System

When fully developed this system could produce individual or combined indexes on production, utility and classification characters for bulls and cows. To operate efficiently it must be able to accept data from State production recording systems, the proposed breed society system and those systems collecting utility data.

It will require a national A.B. sire identification system and maintenance of national historical files on animals. It will need a large computer capable of efficient manipulation of large data sets and the development of sophisticated software.

6. Utility Characters

Data on udder, jaw, feet and legs, temperament, ease of milking, etc., are commonly collected on A.B. progeny test daughters, sometimes in conjunction with a production recording system. Little effort has been made in standardizing the characters measured, their measurement or expression of results.

SYSTEMS DESIGN

Modern computer technology and increases in labour costs have tended to reduce the requirement for 'efficient' program writing. But for large files which are accessed frequently, economics can accrue from careful system design. Brief discussion of optimum design is difficult because it is influenced by a number of factors specific to the location and function of the system (e.g. type, size and peripherals of the computer, file sizes, frequency and accuracy of data input, frequency and nature of report preparation and the types of analyses performed on the data) but any system

must consider at least the following;

a) Input data - frequency of input
- alternative modes of input
- computer use to generate future input data

b) Output - content, nature and frequency of reports

c) Editing facilities - basic editing of input data
- record formats
- range checks on pertinent fields
- missing data
- relationship editing of input data to information already on file.

d) Algorithms used for data manipulation.

e) File design and storage medium
- number of files to be used, based on frequency of access and proportion of file accessed each run
- the use of tapes versus disc, and if disc, whether access is sequential, indexed or random
- variable or fixed length records

An example of one approach to these aspects is contained in a paper by Youl, outlining the herd recording system operating in Victoria.

SYSTEM INTERACTIONS

Unless mandatory for operation, greatest efficiency can be achieved by the collection and storage of data on any character in one system only, then transfer that data to other systems as required.

Potential major transfers are:

a) production and allied data from State production recording systems to breed society and N.D.H.I.S. files;

b) breed society data (pedigree and classification) to the N.D.H.I.S. files; and

c) the use of breeding data to verify parentage and calving dates on production recording systems

Before these transfers are possible, at least the following will have to hold:

a) transfer file design should be uniform since data are derived from more than one source. A range of file inputs would require separate and largely duplicate software;

b) if the sending and receiving computers are different then tape or

other medium incompatibility will have to be known;

c) identification systems will have to be standard or duplicated. For example, the N.D.H.I.S. indexing system would require a national A.B. sire identification system invoked at the State production recording level prior to the receipt of any data. It may, however, be more efficient to use a cross-referencing system when receiving data from breed society files. Correspondingly, State production recording systems will have to carry breed society identification on their files to transfer production data to that system;

d) a schedule of transfer dates will have to be described and adhered to, if the receiving system is to utilize its data efficiently.

SOFTWARE DEVELOPMENT

If computerization is justified various mechanisms can be used in its development:

a) Use a commercially marketed 'package' of programs. An example would be systems designed for the recording and retrieval of pedigree and classification data. Advantages include access to sophisticated software for a small initial outlay, minimum reponsibility for on-going maintenance and rapid system acceptance, but such packages often lack the flexibility to satisfy specific requirements. Software changes may be difficult, impossible or expensive. Many of the statistics packages now available are excellent as analytical adjuncts to survey or research projects.

b) Use programs developed by others for a similar purpose. Changes are often necessary because of specific requirements and changing other peoples programs is not easy, particularly if they were written for a computer significantly different in language detail, word length or file structure. However if the programs are suitable for transfer, are available and perform the correct functions, then it is a cheap and rapid method of software development.

c) Use of contract programing, where all specifications have to be particularly explicit, exhaustive acceptance testing is necessary and programs require complete documentation. Initial development may be expensive but will generally be rapid and, providing consultation is detailed and frequent, will perform efficiently.

d) Develop the systems 'in-house'. More expertise is required on staff but greater flexibility and lower cost normally results.

e) A combination of the above, particularly c) and d). This approach has successfully been used in development of the system of production recording in Victoria.

REFERENCES

PEARSON, R.E. (1978) Development and Philosophy of Data Handling Systems for a Research Dairy Herd. *J. Dairy Sci.* 61: 1847.

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