

## **Livestock Informations Management System (LIMS)**

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### **1. The Problem**

Research is based on making and recording observations. The analysis of experiments and surveys and the conclusions and recommendations based on such analyses are not possible without a set of data.

The usefulness of a data set is determined to a large extent by its quality and accessibility. Quality factors are completeness and correctness, accessibility is determined by data structure, storage medium, documentation and access software.

Livestock performance data can be very complex, especially if they originate from different environments, if traits from different performance categories such as production, reproduction and health are included, if repeated observations especially on reproductive events are recorded and if recording stretches over a long period of time, involving successive generations of animals.

### **2. History of LIMS**

In recognition of the importance of data handling in livestock improvement and the many problems associated with it; ILCA surveyed the market for commercially available livestock data management systems, but none would meet all the requirements of African livestock research. The systems available either required large and expensive computers to run or were specialised management packages, useful only for one species and on production system. In response to this situation, ILCA decided to develop its own microcomputer based livestock data management system.

The first data management system developed by ILCA was called IDEAS (ILCA Data entry and Analysis Program). Development of IDEAS started in 1984 and the first version was completed in 1986. By the end of 1987 a questionnaire was sent to all users and potential users of IDEAS. The information received showed that IDEAS was used in 24 projects to maintain records of 254 herds. Although a major step forward in providing an easy to use data management package that would run on a micro-computer, IDEAS had fixed data structure and the inbuilt analysis module had very limited flexibility. With the spread of micro-computers and the development of powerful and sophisticated database management and statistical analysis software, it became clear that a new, more flexible and sophisticated package for the management of animal performance data was needed.

In 1990 ILCA started with the development of a completely new package to be called LIMS (Livestock Information Management System), based on the experience gained with IDEAS. The major parts of the new package have been developed and field-tested. The complete system will be available by the middle of 1992.

### 3. Areas of Data Management addressed by LIMS

The LIMS system consists of several modules of compiled dBASE programs as well as a generic animal performance data set. Raw data are stored in standard dBASE data files.

The SETUP module allows users to define a customised animal performance data set based on the distributed generic data set. The customisation includes modifying existing variables and defining additional data files and variables. This flexible customisation allows users to integrate a large variety of user defined variables into a LIMS data set. Data that are not directly related to individual animal, e.g. meteorological data and household or market survey data can also be integrated to produce a multi-disciplinary LIMS data set.

A LIMS data set can be defined and documented on a file, variable and code-value level. Breed code rules that define each breed code by a specific combination of sire and dam breed codes can be given. Once entered by a user, this definition and documentation becomes part of a data set and can be printed at any time. A special file that can store text documents is available in each LIMS data set. Such text documents could include research protocols, information on husbandry practices or management procedures, detailed post-mortem reports or programs to access and analyse the raw data.

The UPDATE module allows records to be edited in a way similar to dBASE. Extensive user assistance and cross-referencing is available during data entry. The system looks up data and rules already stored in a data set to provide this assistance and helps to reduce manual lookup and calculation. This assistance can help to reduce errors and save time especially for non-observed data, such as parity number, breed code or the selection of a successful mating among a series of matings. In case the identification of an animal changes, a special facility is available to apply this change throughout the entire data set and keep the data consistent.

An initial data validation is carried out during data entry and a more thorough and time-consuming validation can be done using the VALIDATION module. This module checks the entire data set for errors or inconsistencies and produces a printed error report. There are a number of user-defined settings in the validation to allow for differences between species. Depending on the data files and variables defined, more than 80 types of errors are automatically checked for during each validation.

The REPORTING module, which is at present under development, will produce standard reports, such as population summaries and action lists. The idea is to use data that are mainly collected for research purposes also for the management of the animals under study.

Another module under development, the EXTRACTION module, will provide the interface between the mainly data management oriented LIMS system and commercially available statistical analysis packages such as SPSS and SAS. This module will extract data and calculate standard performance traits on an animal as well as on a parturition basis and export these in a format that is easy to import and analyse with commercially available statistical analysis packages.

### 4. Advantages of using LIMS

From an individual scientist's point of view, the advantage of using the LIMS system are the flexibility in designing data sets combined with the in-built knowledge of animal performance data. The software helps to improve the quality of data by enforcing a high level of data definition prior to data entry, and subsequent checking the data for plausibility and internal consistency. Data validation and preliminary data analysis can be carried out concurrent to data recording, without having to rely on specialist computer and data management support. This in turn helps to shorten the time between the end of a project and the final analysis of the data.

From an institutional point of view, the advantage of using LIMS are mainly the aspects of standardisation and documentation. Not only can data sets from different species, production systems and research areas be highly standardised, but also custom written programs for data analysis can be re-used with minimum modification. The documentation features of the LIMS system combined with the concept of integrating the documentation of a data set with the raw data make it possible to archive a LIMS data set with no or minimal external documentation and still maintain a high level of accessibility for secondary users.

### 5. Present Use of LIMS

The LIMS system is already in use with a number of small and medium size data sets including data from a large dairy farm, on-farm performance surveys with sheep and several on-station experiments. The introduction of the LIMS system in an animal traction project and a study for selection for internal parasite resistance are on-going. The above list indicates the wide applicability of the LIMS system.

## 6. Conclusions

The LIMS system is a very flexible tool for managing animal performance data and is applicable in a variety of situations. It helps to improve the quality and accessibility of data by applying extensive error checking and storing the data definition and documentation along with the raw data. The LIMS system can be especially useful with complex multi-disciplinary and multi-locational experimental and survey data that are recorded over an extended period of time.