COMPUTERIZED DATA MANAGEMENT FOR DAIRY FARMS

By

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THESIS

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DECLARATION

I hereby declare that the thesis entitled "**COMPUTERIZED DATA MANAGEMENT FOR DAIRY FARMS**" is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

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CERTIFICATE

Certified that the thesis entitled "**COMPUTERIZED DATA MANAGEMENT FOR DAIRY FARMS**" is a record of research work done independently by **Dr. C. Paul Princely Rajkumar,** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to him.

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Dedicated
To
Beloved Parents

Introduction

1. INTRODUCTION

Dairying, the backbone of Indian economy, sustains the Indian agrarian economy too. India ranks first in the dairy sector because of tremendous efforts in dairy farming. Although considerable improvements have been made to augment the productivity and profitability from dairy sector, Indian dairying scenario still lags behind in imbibing modern trends adopted by dairy countries, in farm management. There have been instances of avoidable gaps between attainable and attained benefits, largely because of productivity differences between dairy farms. At times, these differences are greater enough to pull down the potential benefits that could be accrued from the same animals. This is mainly due to inefficient farm management and inability to evaluate the defects in farm management.

1.1 Record keeping

Analyzing dairy herd records is the first step when evaluating dairy herds. Defects in farm management can be rectified, only through in depth analysis of records. Profitable dairy farming needs maintenance of proper records. As proper record keeping is an essential tool for efficient farm management (Meek *et al.*, 1975, Pepper *et al.*, 1977 and Furman and Hughes, 1992), more emphasis should be given to maintain timely, precise, accurate and adequate data or information regarding various activities.

1.2 Manual recording

Manual record keeping is an onerous and cumbersome process and the data stored in the Manual files could be converted into information, only by complex calculations. Consequently in the process, little effort is made to

analyse the collected data and to use this information for decision–making and further related action. Moreover, conventional way of record keeping requires repeated data entry in different ledgers, which involves more manpower and occupy space, besides inviting errors, while recording the data and these errors are often unnoticed. Efficient manual record keeping with least possible errors requires personals with higher experience and skill and in the absence of skilled persons, the recording becomes more complicated, as replacing an experienced staff is time consuming and is almost practically not feasible. Inaccurate and irregular records make it impossible to ascertain how the farm management is performing and prevent a timely correction of any management problems that may persist. These problems and experiences show the need for simplifying present system of record keeping.

1.3 Computerized record keeping

Computers, a very efficient tool, are now used for planning and management purposes in many spheres. Developing a computerized system to perform dairy farm record management will be an effective approach for storing, retrieving and analysing data for stock management, problem analysis and performance monitoring. This management tool is likely to improve the farm productivity and profitability by proper decision-making and subsequent action, before major production catastrophe occurs.

Computers retrieve and combine necessary data, perform necessary calculation and give the information required. So, computers will play increasingly an important role in farm record maintenance and in the general

upkeep of a profitable venture. There is no doubt, that a major effort in the future will be directed to develop software to use this potential to its full advantage.

1.4 Development of Software

Even though extensive studies have been carried out and sophisticated programmes have been developed for dairy herd management in many developed countries (Lissemore, 1989), only a few softwares are available for dairy herd management usable under Indian farming conditions. Currently available softwares are purchased from developed countries and they are too complex to be applied practically to Indian dairy farms because of managemental differences and there are defects and problems in commercial programmes. Further, purchased programmes are more costly. Therefore, we require flexible, cheaper and simple softwares, which is suitable to our Indian farming conditions for effective data management in dairy farms.

Taking all these into consideration, the present investigation has been carried out with the objective of

1. Developing suitable software for effective data management in dairy farms.
2. To evaluate the shortcomings of present system of data keeping.
3. To evaluate the merits and demerits of the computerized management information system.

Review of Literature

2. REVIEW OF LITERATURE

2.1 Management

Management is defined as a comprehensive activity, combining and co-ordinating human, physical and financial resources to produce and market a produce or service effectively and efficiently. It is concerned with planning; organising, staffing, directing and controlling resources towards accomplishing established objectives and goals (Hutt and Hutt, 1993).

Farm management deals with the ways and means of organising the production factors including land, labour and capital and the choice of crop and livestock enterprise to ensure maximum return. Johl and Kapur (1997) defined farm management as a science of decisions on the use of meagre farm resources having alternative uses to obtain maximum profit from the farm.

To make efficient dairy management decision, thorough understanding of the subsystem and veterinary logic is indomitable. Gafsi (1999) described the management approach to be made on changing farming practices, demonstrated the relevance of an interactive and participatory approach and proposed a few operative aspects of the management approach which are useful for decision makers and farm managers. For maximising the profitability, the farm managers need an insight into the potential impact of their management decisions on technical performance (Mourits *et al.*, 1999).

2.2 Importance of Records

Morrow (1966) stated that for any analysis to assess the performance of a herd, we need to collect all necessary available data. Pepper *et al.* (1977) reported that computerised coding had number of advantages. He added that time involved in keeping records could be greatly reduced.

The basis of good management depends on the provision of precise, up-to-date information so that sound decision on management could be made. The provision of this information required systematic record keeping and prompt and intelligent analysis of those records (Blood, 1979). Gaines (1989) reported that analysing herd records was the first step when evaluating a sub fertile dairy herd. Elmore (1990) opined that accurate and well-maintained records were a key component in any successful dairy reproductive herd health management.

Furman (1990) made it clear that evaluation of an operation is based solely on records and the added that if all the records were in place, you would have all the tools necessary to evaluate the operations success.

Ringwall *et al.* (1992) stated that accurate, simple and efficient record – keeping systems was the base behind the profitability of any operation.

2.3 Constraints in Data Management

Farm animal practices have access to a large amount of clinical data. Recording and pooling of information would enable studies into disease incidence and effectiveness of treatment (Thrusfield, 1983).

Gaines (1989) reported few difficulties in record maintenance in dairy herds. He stated that records were often incomplete or unavailable for analysing the presence of any problem in the herd.

Elmore (1990) explained the difficulty in maintaining records because of volume of data involved in diary herd management and he opined that computers could be helpful and computers could be helpful in maintaining and evaluating diary reproductive herd health records.

Livestock management involves integrated application of the principles of animal breeding, feeding, housing, prevention and control of disease in a specific socio-economic environment. The goal of livestock management is to improve economic efficiency through input use, for which complex veterinary data should be analysed (Huirne *et al.*, 1992).

Saga and Kumar (1999) opined that the main problem in proper recording was lack of awareness among the farmers and unawareness on utility of this data for betterment of the farm.

2.4 Computer and Management

A computer program should be convenient, flexible and it should not require complex calculation or coding and there should be minimal recording on the part of the user (Cannon *et al.*, 1978). Computerised record keeping must be simple, easy to understand, reliable, accurate, and must provide easy access to stored information (Rude, 1986).

Janssen and Bush (1982) used commercially available computer programs for managing medical records in a zoological park. Data from anaesthesia, radiography, clinical pathology, vaccination records and tuberculin-testing records were used. A computerised program had been used since October 1980 by Merrist Wood and Lackham Agricultural Colleges for the management of their dairy herds (Lucey *et al.*, 1983). According to Rowlands (1983), considerable progress has been made towards developing computer software to assist dairy herd management. The interest in computerisation, for the most part, paralleled the development of practice management as a speciality in veterinary practice (Farber, 1986).

The rapid proliferation of relatively inexpensive microcomputers in the recent past has a significant influence on different livestock businesses, especially dairy farms (Bartlett, 1986). In a small farm, manual recording of data and analysis may be adequate. However in large farms, the huge data have to be processed, which would demand the help of an appropriate computer programme. Further a computer system has the potential to

generate a return on investment of 25 to 50 per cent per year besides increasing management efficiency (Taylor, 1986).

Putler and Zilberman (1998) argued that an input that augmented worker ability would increase the productivity of physical labour and computerised book keeping and transaction programs were worker ability augmenting inputs as they could increase the work output per hour.

If one visualises development of an effective and comprehensive computer based information system in order to improve the quality of decision-making and ensures timeliness, the scale and level of computerisation contemplated may be justified (Rao, 1990). Planned animal health and management programmes are useful for maintaining optimal health, increasing production efficiency, maximising income and minimising income fluctuation (Udomprasert and Williamson, 1990). Information technology is one among few technologies having great potential for creating an impact on agriculture (Jones, 1992).

Management Information System (MIS) technique supplies managers with information that would permit them to plan and control operations. Computerised farm analysis makes it easy to measure farm performance (Huirne *et al.*, 1992). Lissemore *et al.* (1992) described the use of a computer based herd management information system to monitor dairy herd performance in Southwestern Ontario by collecting data on reproduction, udder health, production and heifer performance and reporting. Computerisation of MIS has added new dimensions, such as speed,

accuracy and processing of increased volumes of data that would permit consideration of more alternatives in a decision making (Devanand, 1995).

Shaw *et al.* (1999) opined that a 'paperless' laboratory, using bar codes or keypad for entering data onto a computer system would substantially reduce the time and improve the accuracy and efficiency of data entry, which is essential for any microbiology laboratory.

2.5 Computer Application in Veterinary and Animal Sciences

Thrusfield and Hinxman (1981) described the use of a computerised system for storing veterinary clinical case records in coded form and displaying the data with the advantages of economy of coding, speed of access, simplicity of data inputting query flexibility and rapidity of searching.

With the dropping hardware prices and proliferating less veterinary microcomputers, it has become increasingly cost effective for veterinary offices, dairy farms, cow-calf operations and feed lots to computerise various aspects of their operations (Bartlett, 1986).

Computers, because of their versatility, speed, accuracy and diligence, have been used in many areas of human activity and veterinary field is not an exception. The search for software that could be used in veterinary practice started in early 1970's although the computer programmes did not seem to understand veterinary logic and practice (Farber, 1986).

Good records are the foundations of good management. Predefined specific parameters such as cow's attitude, condition, weight and calf weaning weight should be collected along with proper animals identification number for developing a master plan for dairy operations (Furman and Hughes, 1990).

Individual analysis of costs could determine the most economical method of obtaining replacement heifers (Gabler *et al.*, 2000). For this, a cost analysis spread sheet with Excel 97 Microsoft file was developed, which estimated the costs to raise a replacement heifer by specific age classes for feed, labour, health reproduction, breeding facilities, equipment, mortality, and interest cost.

Computerised veterinary support system aids the veterinarian in all areas of veterinary decision-making and livestock management. Inadequacy of suitable software at affordable prices, lack of interest from the part of veterinarians to evaluate the benefits of computerisation and monopolistic situation in veterinary practice, limited the actual use of computers in veterinary field (Thirunavukkarasu, 2000).

2.5.1 Dairying

Major features of an integrated management information system for application in dairy production were described as capabilities to process records for evaluating current and historical states of the business. To project anticipated events and performance in the immediate future as a

means of monitoring and controlling current activities and to provide both long and short-run projections of physical and financial performance as an aid to planning and decision making (Bywater, 1980). The first use of computer as a management tool in dairying was in milk recording services started in 1950's in the United States. Using data processing and punch card equipment, different programmes were developed to store the milk recording data. Collectively, these organisations came to be known as Dairy Herd Improvement Association (Voelker, 1981).

Bartlett (1986) conceded that computerisation might not be beneficial for herdsman unless he or veterinarian was willing to diligently record the data, otherwise computerised chaos with faster confusion would result.

With the advent of official milk recording and computerised records, Dairy Herd Improvement (DHI) programmes promoted the need for, and use of unique individual animal identification. The records were intended to provide information to farmers on individual cow production (Lissemore, 1989).

A microcomputer expert system for dairy herd reproductive management was developed by Domecq *et al.* (1991). Management information system performs processing and analysis of data, yielding information that still needs to be interpreted, a knowledge-based system provides information and step further that can interpret the information to the level as a human expert would (Hogeeven *et al.*, 1991). Ringwall *et al.* (1992) opined that herd records could be used to appraise overall cowherd productivity and genetic evaluation of breed. They described the use of

computerised record systems, CHAPS II (Cow Herd Appraisal and Performance Systems II) for collection and interpretation of cowherd data. Chang *et al.* (1992) developed a computer program to automate the collection and evaluation of milking parlour performance data. This system could be used to obtain a complete nation wide parlour operation database to enhance the usefulness of the information. Application of an expert system program technology to dairy herd management was also reported by Schmisseur and Gamroth (1993).

An expert system for technical management of dairy enterprise was developed by Pellerin *et al.* (1994) to analyse two kinds of criteria namely, allowing detection of problems in main sectors of cow management and identifying potential factors causing those problems.

Recent advances in information technology enable in-time recording and management support of individual cows (Asseldonk *et al.*, 1999). Data Envelopment Analysis (DEA) was a useful tool to assess the technical efficiency of a dairy farm. DEA yields a more consistent measure of efficiency and it identifies those inputs and outputs that are under-utilised (Fraser and Cordina, 1999).

A dairy software package, Dairy Comp, has been used extensively as an on-farm system in California dairies. It differed from the previously described systems in that it was extremely useful for data manipulation and reporting (Goodger, 1999).

DAIRYPRO, a combination of decision support system and expert system was designed by Kerr *et al.* (1999) for strategic planning on subtropical dairy farms. The programme was designed in such a way that it could be run by dairy extension officers as a consultation package for farmers.

Advanced developments in computer software introduced the concepts of artificial intelligence with the help of artificial neural network (Heald *et al.*, 2000) and expert system, which is a knowledge based information system.

2.5.2 Reproduction

Reproductive inefficiency is one of the most serious and frustrating problems of dairy farms because of the economic losses associated with poor production and causes are not always obvious and difficult to correct. Most of the farmers were unaware that they had a problem or that economically advantageous changes could be achieved by a planned reproductive programme (Blood *et al.*, 1978), despite the fact that reproductive health programme with due consideration for oestrous detection, correction of nutritional deficiencies and prompt treatment of genital tract disorders in individual animals have improved the reproductive performance (Morris *et al.*, 1978) . Reproductive efficiency of most dairy herds is currently below optimum (Varner *et al.*, 1989). The results of intensive integrated reproductive management education programs for dairy producers indicated that the reproductive efficiency of their dairy herd has improved mainly because of the improved efficiency of detection of oestrous and better

reproductive management after acquiring the knowledge through this program.

Meek *et al.* (1975) described the capability of a computer program to analyse the reproductive efficiency of dairy herd using, the system generated parameters like days open, calving to first heat, calving to first service, number of services per conception, average number of problem breeders per interval and average days open for problem breeder. A computerized method of record keeping permits the user to obtain a herd fertility summary, listing various parameters of reproduction (Williams and Ward, 1989). Ko (1992) developed a herd health computer program, which provided herd health reproduction summary and economic analysis comparing current values with performance targets and the practice average.

Plaizier *et al.* (1997) found that the estimation of financial losses from sub-optimal reproductive performance was more accurate when adjusted calving interval was used as a measure of this performance by using a stochastic model in a computer simulation program for Ontario dairy herds.

Using a computer program named VIRUS (Veterinary Investigation Recording User System), Martin *et al.* (1982) produced fertility control action lists and fertility analysis. This program was further developed to analysed data in such a way that it would be possible to search for genetic difference in sire progeny groups and cow families in their susceptibility to infertility. To computerise the reproductive management, it is necessary to observe and record calving date, dates of oestrous, AI done, bull identity and

result of pregnancy diagnosis. Domecq *et al.* (1991) developed a microcomputer expert system in this line for dairy herd reproductive management, which was used for problem identification in areas of conception rate, days open, days to first breeding and detection of oestrous. Recommendation and suggestions were provided for problems identified and the system tool approximately 10 minutes to evaluate the reproductive performance and management policy of the herd.

Lucey *et al.* (1983) conducted a field trial of COSREEL (Computer System for Recording Events affecting Economically important Livestock), a computerized recording system for herd health management, and found that it was a valuable tool for routine veterinary use, particularly for infertility investigations. Elmore (1990) developed a computerized dairy reproductive herd health program, which interpreted the information from barn report of dairyman and veterinarian's palpation results about the cervix, uterus and ovaries.

A microcomputer photocell system was developed for create-confined sows for predicting farrowing time to enable the user to monitor the progress of a sow towards parturition without making frequent visits to the farrowing area (Erez and Hartsock, 1990).

Using computer as a tool, the veterinarians can efficiently offer many more services than that were offered in the past and that include monitoring reproductive parameters and comparing these parameters with those of other dairies (Ko and Stalheim, 1992). A computer mate selection programme could be helpful to reduce inbreeding and to increase farm profitability.

Because of the optimal mate selection programme, total gain in expected lifetime profit per mating was $37.37 in Holstein and $59.97 in Jerseys (Wergel and Lin, 2000). Application of this programme to control inbreeding in large commercial dairy herds could be of tremendous economic benefit, by helping in sire selection and in mate pair allocation.

2.5.3 Nutrition

The main objective of a nutritional programme is to feed the animals with quality inputs at an affordable cost. Stallings *et al.* (1985) designed a computer program to calculate ration's dry matter, crude protein, total digestible nutrients, acid detergent fibre, cost, macro-minerals and micro-minerals. This program had been used extensively by extension personnel, faculty and students for ration evaluation, problem solving, trial-and-error ration balancing and as a teaching tool to demonstrate the mechanics of ration balancing with the advantage of simplicity of operation and flexibility of ration formulation.

Galligan *et al.* (1986) developed an interactive computer program for ration evaluation and formulation. This program, with five sections namely, nutrient requirement, feed bank, computational feeding recipe, and a comparative economic evaluator was intended for lactating and non lactating cows.

A computer program was written by Ely *et al.* (1991) to calculate the economic replacement value of feeds.

Computerised dispensing of concentrates could economise on consumption of concentrates when grouping and feeding different total mixed rations are impossible (Maltz *et al.*, 1992).

2.5.4 Health

Meek *et al.* (1975) critically studied a computer program to gather, record, analyse and report data relating to the health of dairy herds. The information obtained from the herdsman was coded on the cow and dairy coding forms and processed under cow subsystem, table subsystem and dairy subsystem. An animal health program was a planned and coordinated approach to achieving and maintaining optimal health and productive efficiency of livestock (Blood *et al.*, 1978). Morris *et al.* (1978) conducted a study of mastitis prevalence in 10 dairy herds, which participated in a herd health program and found that the procedures reduced mastitis prevalence, incidence of clinical mastitis and disposal of cows due to mastitis. An economic analysis of the health and management program in dairy herd has been described by Williamson (1980) and further modifications were made by Williamson *et al.* (1980). The objectives of such programmes were to maintain optimal health and increase the production efficiency of livestock, thus maximising income and minimising income fluctuations (Udomprasert and Williamson, 1990).

Computerised tabulation and statistical analysis of results would be extremely helpful in practice and research with potential for modelling disease patterns and future economic events (Sard, 1981). Janssen and Bush (1982) designed a system for computerising clinical medical records at a

zoological park, which helped to store and retrieve animal inventory data, daily medical and surgical records, results of faecal examinations and anthelmentic treatment records. Williams and Ward (1989) developed a menu driven recording system which helped to obtain reports in a detailed format, with all clinical findings and treatments to indicate new health problems and to monitor the progress of current farm problems. Udomprasert and Williamson (1990) developed an animal health management software program to perform health management functions, which could be integrated with decision-making programs.

Hall (1980) described about a computerised diagnostic recording system (Veterinary Investigation Diagnostic Analysis – II) for veterinary investigation centres in Great Britain. The system depended on an agreed list of 393 possible diagnoses and the diagnostic records were sent each month to a computer centre for producing an annual record of all diagnosis. Martin *et al.* (1982) developed a program, ***VIRUS*** (Veterinary Investigation Recording User System), which was used in cow herd health and productivity project with the aim to have an inter-disciplinary approach to herd health and productivity of dairy cows, to monitor the incidence of the common diseases, and to establish programmes for their prevention or control.

Rowlands *et al.* (1983) designed the use of ***COSREEL*** (Computer System for Recording Event affecting Economically important Livestock), a computerised animal health recording system with a versatile coding system for recording diagnosis, symptoms and medical and surgical treatment,

which had been tested by a research institute (Russel and Rowlands, 1983) and by two agricultural colleges (Lucey *et al.*, 1983).

List *et al.* (1984) put forth a computer program that provided a quantitative measure of the potential loss in milk production due to sub clinical mastitis. This program provided a good measure of daily milk loss per cow in the sample herd and the associated economic loss per cow.

Morrison and Morris (1985) developed an interactive computer based guide, RESPITE, which could be used as an educational tool in which subjective judgement and experience had been made to convert published observation into risk factors associated with pneumonia, while operating in one or more of the three stages of pig production. This program was tested in four herds and comparison of predications with slaughterhouse data indicated that the guide was realistic in its estimates.

Ko (1992) designed a herd health computer program Vetcheck IV, which provided assistance in basic record keeping, formulation of action lists and herd analysis. Herd health report could be obtained by the print menu, which displayed treatment, vaccination, mastitis, dry off examination and body score reports.

Lees *et al.* (1993) evolved a computer program called CRITTER specifically to track pedigree, location, health status and productivity of individual research animals of different species, which could also be modified for use in area health surveillance programs.

To overcome problems faced by the management, a NICNET based information system for the monitoring and management of animal health activities in the Kerala state had been designed and a suitable software DISNIC-MISA (MIS for Animals Health and Administration) had been developed and implemented (Nair, 1994).

A diagnostic computer module could be used to broadly classify bacterial causes of mastitis in dairy herds with the help of field survey (Heald *et al.*, 2000).

2.5.5 Epidemiology

Epidemiological calculations are often necessary for a correct and easy interpretation of data, but in practice are often not performed because veterinarians are unfamiliar with underlying epidemiological quantitative principles and formulae. A computer program named, EPISCOPE, had been developed for teaching and practical field use of these principles and calculations (Frankena *et al.*, 1990).

Using a fairly universal representation of state-transition computer models, Jong and Drekmann (1992) derived an analytic expression for the basic reproduction ratio of infection.

Using hypertext technology, a computer based user interface for the delivery of epidemiological models and associated information was developed by Reid *et al.* (1996). The program, E_QWISE provided a single

user interface facilitating access to different types of disease model and expert system for equine health and welfare.

2.6 Knowledge-Based System

Extending the traditional record keeping system with computerized decision support and expert systems could make them more valuable for the decision making process of individual pig farmers (Huirne *et al.*, 1992).

Schmisseure and Gamroth (1993) designed an expert system, DXMAS, to diagnose dairy management problems and the field tests identified 95 management problems and estimated annual lost income opportunities ranging form $25 to $ 450 Agricultural Extension Services.

2.7 Need for Computerized Recording

Britt and Ulberg (1970) opined that there should be a system to measure accurately the concurrent reproductive performance of a herd. Gaines (1989) reported the role of record analysis in evaluating subfertile dairy herds and opined that the herd required in-depth analysis of different variables, which reduced fertility and their interaction to identify the probable cause and their correction.

Chang (1992) established that use of computer systems for milking parlour operations excluded the human error that is possible in other manual recording procedures that could occur from transferring or calculating data,

thereby reducing time and effort required and enabled extensive data collection.

Lissemore *et al.* (1992) opined that the record maintenance system to achieve their full potential required the use of computers for analysis of large amount of farm data.

Rowlands (1993) recommended that the data need to be collected and stored by computer system in livestock recording for dairy herd management for wider statistical and epidemiological analysis.

Saga and Kumar (1999) stated that the information from the records should be made available to the farmer quickly and in simple forms.

Materials and Methods

3. MATERIALS AND METHODS

3.1 Study area

The study was conducted in the University Livestock Farm (ULF), Kerala Agricultural University, Mannuthy. The 15 hectares cattle farm is located near Thrissur – Palakkad national high way, six kilometers east of Thrissur town. The farm has 156 hectares area out of which 69 hectare is utilized for fodder cultivation. The farm is maintained for teaching, research and extension activities. The recording system and the records of the farm were utilized as the base material for the study.

3.2 Record keeping in the KAU Farm

The prevailing system of management and data recording at the farm were observed and data related to various aspects of day-to-day management such as production, reproduction, treatment and base information records were utilized. Based on the information collected, the merits and demerits of existing recording system were identified, by comparing with standard recommendations (Package of practices recommendation, 2001).

3.4 Development of Computerized Management System (CMS)

All the necessary input requirement for developing CMS was identified. The unwanted inputs present in the existing system of traditional record maintenance were studied.

Number of entries to be made for data entry in each register was observed in case of manual recording system. Number of repetition of entries present in the existing system of recording was studied. Based on the findings the computerized data management system was developed by incorporating all the necessary information required for efficient data management. Unnecessary inputs present in the manual recording systems were neglected in the computerized data management system. Repetition of entries was also avoided.

3.4.1 Livestock Register

The input requirements necessary for maintaining livestock register were assessed. The required reports that could be generated from livestock register were also assessed and programs were written for generating reports.

3.4.2 Treatment Register

The format for recording daily treatment particulars was prepared. The necessary outputs that can be obtained from treatment register were prepared.

3.4.3 Growth Register

The inputs for recording growth particulars of animals were analyzed and prepared. The growth was recorded in every fortnightly interval. The possible reports, which could be obtained from growth register, were designed

3.4.4 Breeding Register

Based on the requirement of inputs for a perfect breeding register, the format for breeding register was prepared. The important reports, which have to be prepared, were formulated.

3.4.5 Milk Recording Register

The format for day-to-day recording of milk production of individual cows was prepared. All the important reports, which were required from milk recording register, were formulated.

3.4.6 Other registers

The format for other important registers like livestock register, birth register, artificial insemination register, milk distribution register and mortality register were prepared in a similar manner based on the input requirement. All the necessary reports that could be prepared from those registers were also formed.

3.5 Reports

Model reports were prepared from every register. The time requirement for preparing those reports both by manual and computerized recording systems were measured.

3.6 Retrieval of Information

The time taken for retrieving the information from the records was studied. Number of record books to be referred in manual recording system and number of worksheets to be referred in computerized recording system, were observed for retrieving the same information.

3.7 Man-Hour requirement

The time taken for recording every register in the farm was recorded daily for three months. The mean time requirement for recording each register for a day entry was calculated. Similarly the same data were fed into the computer and the time taken for recording was measured.

3.8 Statistical analysis

The time requirement for data entry in each register in both manual and computerized recording system were analyzed using paired 't' test (Snedecor and Cochran, 1994).

3.9 Selection of Software Package

Based on the information obtained and anticipated reports required for efficient data management in dairy farms, CMS with a combination of Visual Basic 6.0 and Microsoft Access 97 were used.

3.10.1 Visual Basic 6.0

Visual Basic 6.0 is a member of the Visual studio 6.0 family of development products. The 'Visual' part refers to the method used to create the Graphical User Interface (GUI) and the 'Basic' part refers to the BASIC (Beginners All-purpose Symbolic Instruction Code) language. Visual Basic 6.0 was used as front end for displaying the results and recording of data.

3.10.2 Database Connection

Visual Basic provides various methods to connect database for handling stored data without loosing their integrity. In this package, Microsoft Data bound Grid Control 5.0 was used for this purpose.

3.10.3 Microsoft Access 97

Using Microsoft Access 97, various relevant records were stored according to the requirement. Microsoft Access 97 was used as back end, for storing the data, with necessary coding, connecting the front and back ends.

3.11 Trial running of the CMS

All the data were recorded in the respective register using the developed CMS for a period of three months. The merits and demerits of the CMS were assessed. After the end of the trial running period, refinement of the CMS was done based on the defects or modification required.

3.12 Evaluation of CMS

Evaluation of the developed CMS was done by comparing the conventional system of recording, taking into account the parameters like man-hour requirement, retrieval time etc. for three months.

Results

4. RESULTS

4.1 Existing System of Data Management

The manual recording system followed in the Livestock farm has nine essential records as given in Table1. Farm supervisor and farm assistants are bestowed with the duty of record keeping. These officers are also the custodians of these registers depending on their hierarchy. Different sets of information generated and evolved in the farm are regularly entered in these registers.

4.2 Evaluation of Recording System

During the study period of three months, both manual and computerized recording systems were evaluated. In spite of availability of enough technical persons for carrying out the manual recording system, the farm records are often involving additional man-hours for their upkeep and regular entries. The number of entries to be made for a single recording in the manual recording system and computerized recording system are presented in Table 1.

The computerized recording system contains only bare minimum and necessary inputs with single entry. Referring to different registers can be done very fast. Because of these reasons, the time taken for a set of entry in the computerized recording system was found to be less when compared to the manual recording system.

In manual recording system, most of the parameters require entry in more than one record book, due to limited entering capacity. Whereas computerized data management system required entry in single working sheet. In manual recording system, treatment register has some unnecessary entries. Breeding register upkeep required referring of birth and livestock register. Growth register required more numbers of entries. Milk recording register has numerous entries. Milk distribution register and livestock register has unwanted entries. Mortality register required referring of livestock and birth registers. Hence, in manual record keeping system for making the record up-to-date cross-reference has to be made between records of the farm.

4.3 Time requirement

The time involved in recording each registers under manual and computerized system is presented in the Table 2.

4.4 Retrieval of Information

It was observed that in manual recording system, minimum time required was 30 minutes for retrieving information depending upon the volume of information required. The same information was retrieved within

Fig. 1 Welcome page

Fig. 2 Login form

five minutes in computerized recording system. This process of retrieval was very fast.

4.5 Computerized Recording System

4.5.1 Menu System

The program is comprehensively modular and the menu system is easy to operate. The main menu contains several submenus each of which produces another active menu.

4.5.2 Welcome Page

This is the opening page of the developed software for the data management of dairy farms, which is presented in Fig1.It consists of two label buttons namely **Enter** and **Exit.** A click on Enter, opens a logic form click on **Exit,** generates a message box which asks for confirmation to quit from the activity click, on 'yes', will close the program.

4.5.3 Login Form

This form has a **username**; **password** and command buttons **OK** and **Cancel**. This password protection will save the records from unauthorized tampering and manipulation. A click on the **OK** button, leads the user to the main menu. The format of login page is presented in Fig 2.

Fig. 3 Main Menu

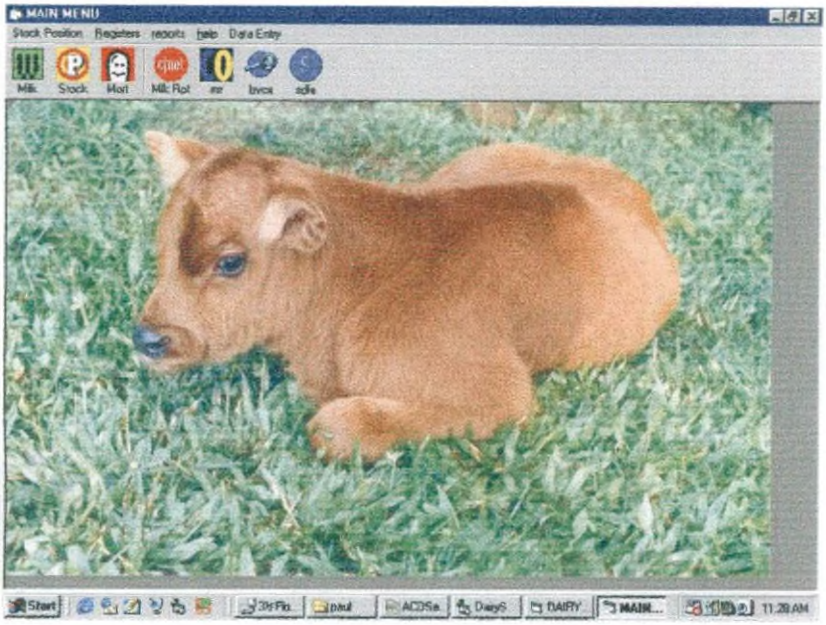
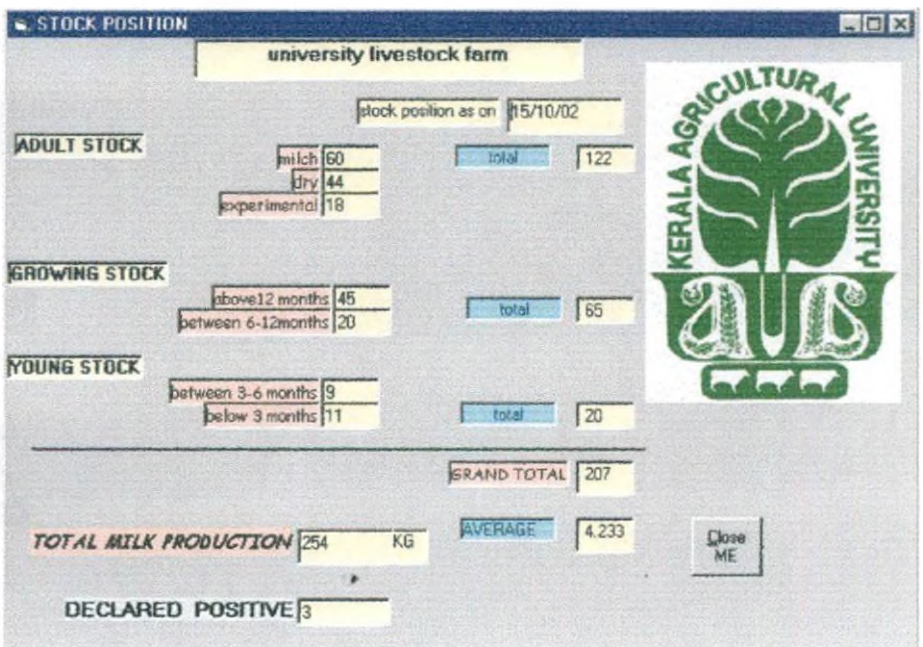


Fig. 4 Stock position



4.5.4 Main Menu

The main menu is designed with a pop-up menu. This produces on selection another active menu that overlaps or hides the previous choice.

The main menu consists of different submenus *viz:* Stock position, Registers, Reports, Data Entry and Help. A choice can be selected by placing the cursor over the chosen item and clicking it or pressing the **ALT key** and underlined letter of the menu item. Fig3 shows the details of main menu.

A tool bar is placed just below the sub menu. This tool bar consists of several reports, which can be obtained directly, *viz:* Milk recording report, stock position and mortality report. This tool bar can be utilized for generating reports.

4.5.5 Stock Position

The format for stock position is depicted in Fig 4. Clicking the sub menu; stock position, a new page will open which gives the details of present stock position of the farm as on date. The stock position shows the details such as total number of the animals in adult stock (Milch, Dry, Experimental), growing stock (above 12 months between 12 months) and young stock (between 6-12 months, above 12 months). It also includes the grand total. It further provides information on total milk production. The

Fig. 5 Registers

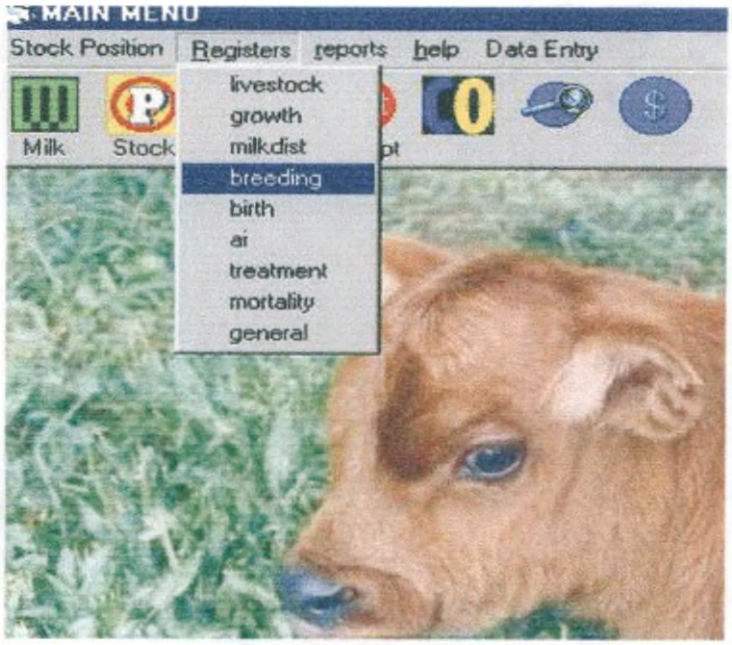
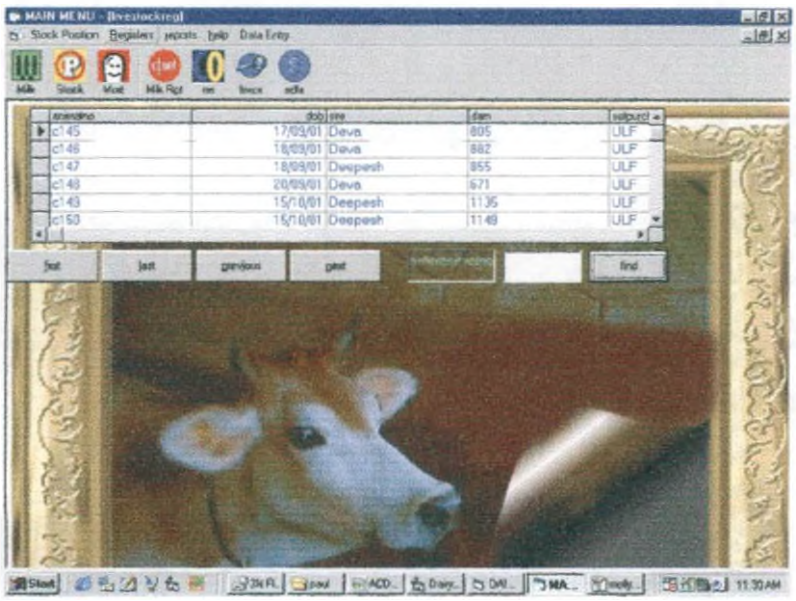


Fig. 6 Livestock register



total milk production in kg, which is obtained from the milk distribution register, would be automatically displayed in the stock position sub menu.

The stock position sub menu contains a field called 'average'. This icon refers to the average milk produced for the particular day. It was calculated by dividing the total milk production by the number of milch animals available. Number of animals declared pregnant could be read from the sub menu. Number of pregnant animals would be evaluated from the breeding register and displayed automatically.

An option button namely **close me** allows the user to close the sub menu stock position.

4.5.6 Registers

The second sub menu registers, has a dropdown menu which contains various registers *viz.*, livestock, growth, milk distribution, breeding, artificial insemination, treatment, mortality registers and a general option. The submenu registers with its various options are presented in Fig 5.

4.5.6.1 Livestock register

The option 'livestock' in the submenu registers allows the user to view the livestock register. It contains details of the animals *viz.*, animal number (Identification), date of birth, name of the sire, name of the dam, source of purchase and remarks (Fig 6). The option, 'remarks' provide

Fig. 7 Growth register

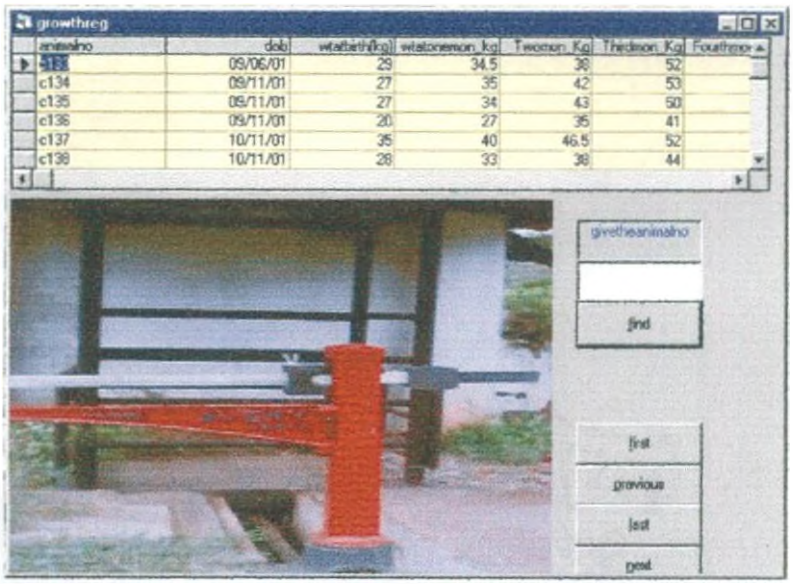
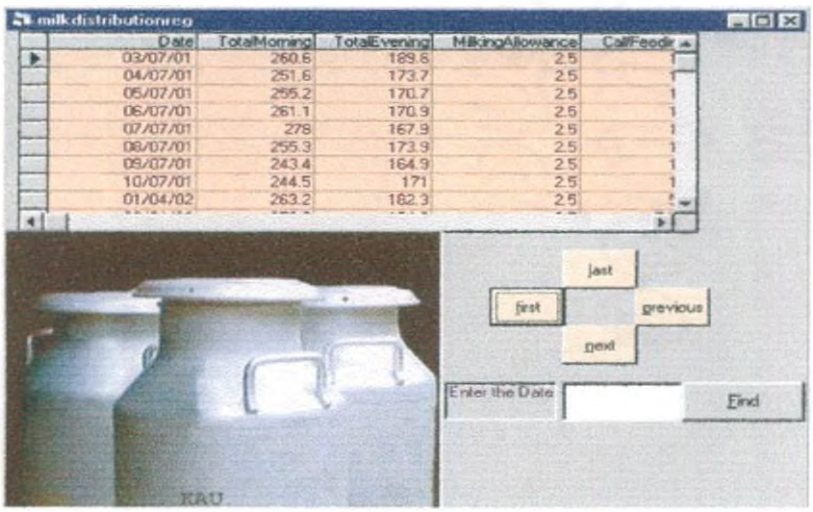


Fig. 8 Milk distribution register



information about the current disposal status of the animal (sold, died, culled).

The livestock register contains options to find the records of the first and last animal. The identity details of all the animals present in the record could be revoked by incorporating the animal number in the **Find** option or by activating the **First, Next, Previous** and **Last** options.

The livestock register could be closed by clicking the **Exit** option present in the register. The register could also be used for recording the details of the animals.

4.5.6.2 Growth register

By activating the growth option, the growth register would be opened. It contains details such as animal number, date of birth (dob), weight at birth, weight of animals from first to the twelfth month and weight of animals at six month interval (Fig 7). It also provides, facilities to add and delete records. The details of all the animals present in the record could be revoked by incorporating the animal number in the **Find** option or by activating the **First, Next, Previous** and **Last** options.

4.5.6.3 Milk Distribution Register

The third option in the submenu registers helps to display the milk distribution register on the screen. In the milk distribution register, options are available for incorporating data such as total milk yield (morning and

Fig. 9 Breeding register

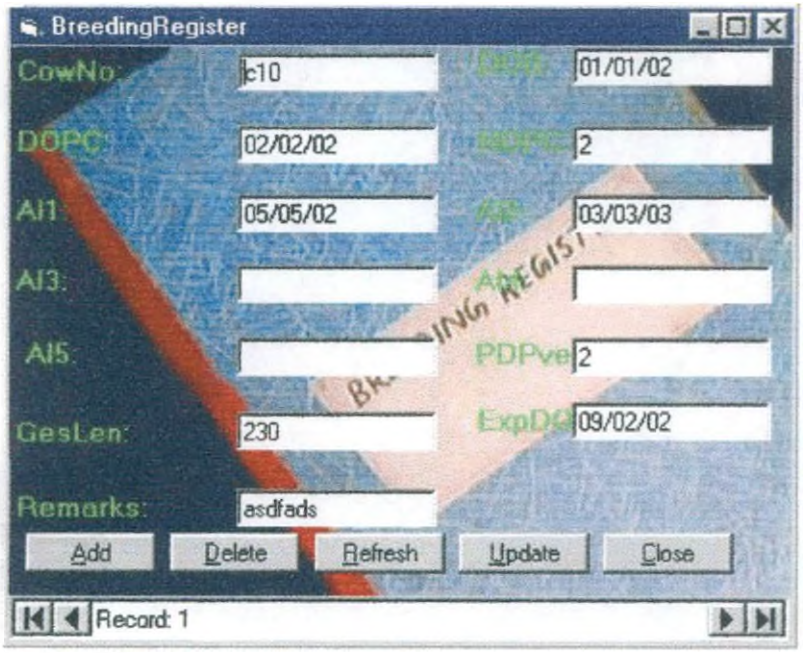
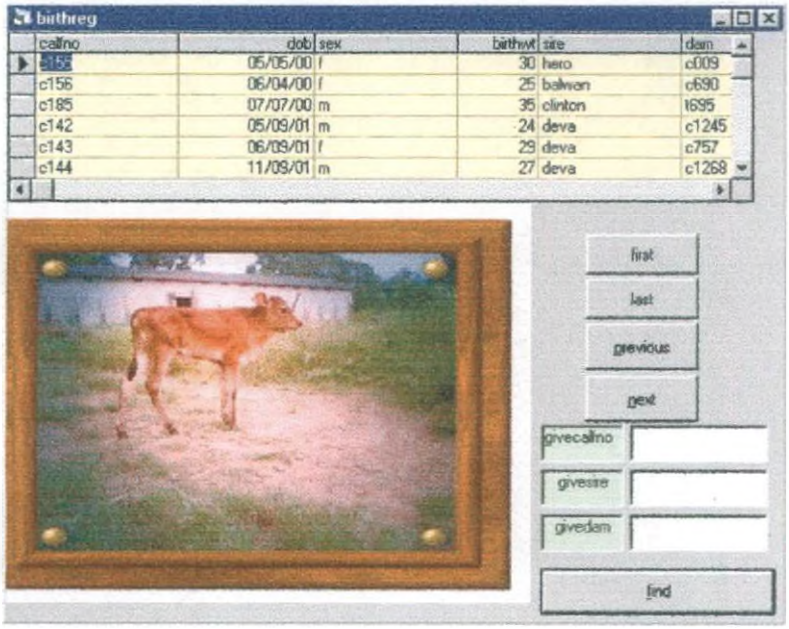


Fig. 10 Birth register



evening), milking allowances, calf feeding, milk supplied to the dairy plant (morning and evening), coupon sales, grand total and remarks. This format is depicted in Fig 8.

The milk production (kg) for any day would be obtained by entering the particular date and clicking the **Find** option.

This register also provides facilities to revoke the details of all the animals like that of the livestock and growth register.

4.5.6.4 Breeding register

The fourth option in the submenu registers, leads to breeding register. The breeding register contains details such as cow number, date of birth, date of previous calving, number of previous calving, first artificial insemination, and second AI (Artificial Insemination), third AI, fourth AI, fifth AI, expected date of calving, gestation length, and remarks (Fig 9). This menu also has option buttons like **Add, Delete, Refresh, Update** and **Close**.

4.5.6.5 Birth register

The fifth option in the Sub menu registers, displays the birth register. Fig 10 shows the format for birth register. It contain details such as calf number, date of birth, sex, birth weight, sire and dam. Details regarding the calf could be retrieved by incorporating the calf number or the sire name or the dam name in the relevant text boxes and clicking the find option. This

Fig. 11 Artificial Insemination register

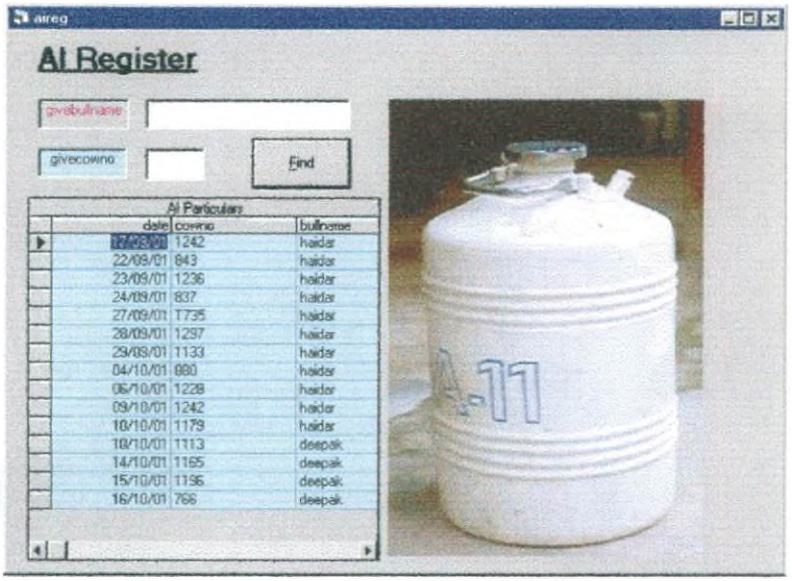
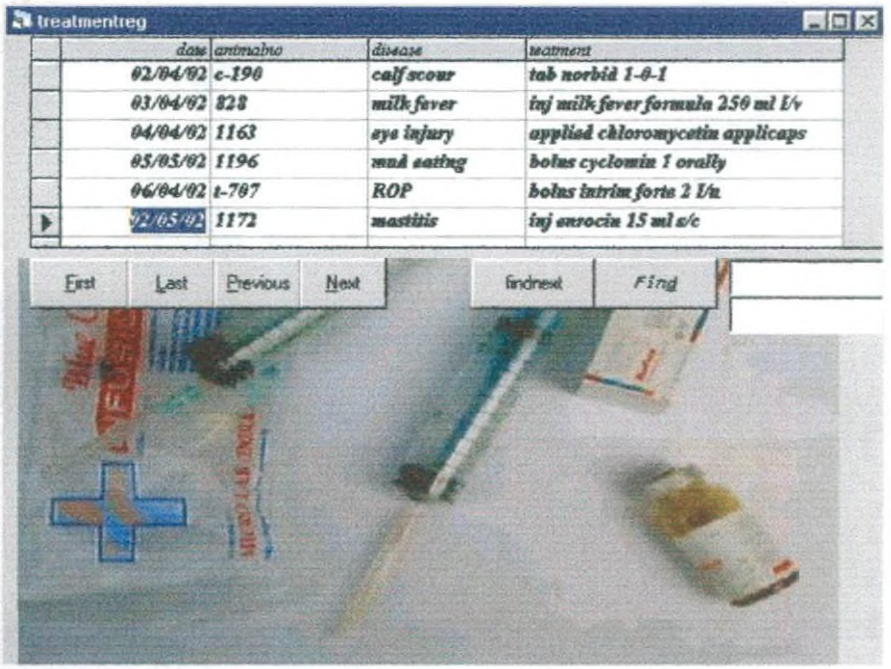


Fig. 12 Treatment register



sub menu allows the user to **Add** and **Delete**, to view **First, Next, Previous** and **Last** records.

4.5.6.6 Artificial Insemination register

The sixth option displays the artificial insemination register on the screen. The input format for artificial insemination register includes date, cow number, sire name and remarks. Typing the cow number and activating the find option could highlight the information regarding artificial insemination particulars of any animal in the register. The animals that are covered by a particular sire could also be obtained by feeding the sire name in the relevant field. The format for artificial insemination register is given in Fig11.

4.5.6.7 Treatment register

The seventh option directs the user to view treatment register. Figure12 illustrates the format of treatment record. This register provides details regarding day of treatment, animal number, disease and treatment. This sub menu provides the user to add, delete and view the records. The user can select the **First, Next, Previous** and **Last** buttons to view the respective records.

4.5.6.8 Mortality register

The mortality option displays the mortality register. The input format of mortality register provides details about year, animal number, sex, date of

Fig. 13 Mortality register

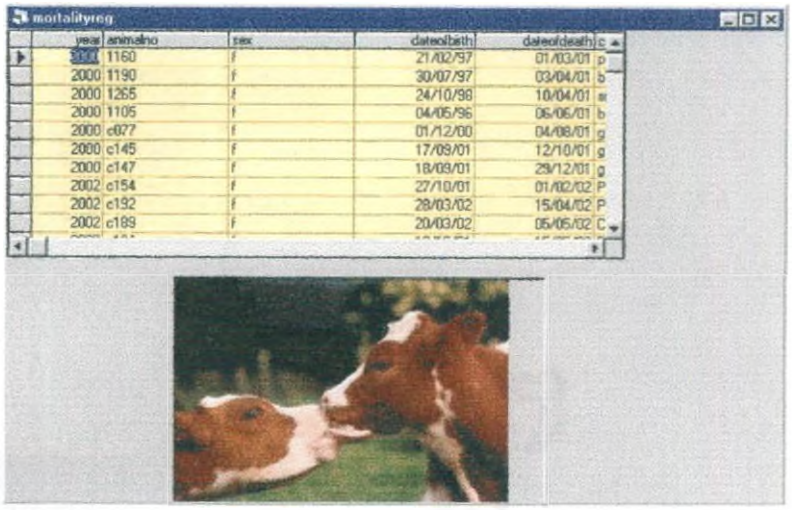
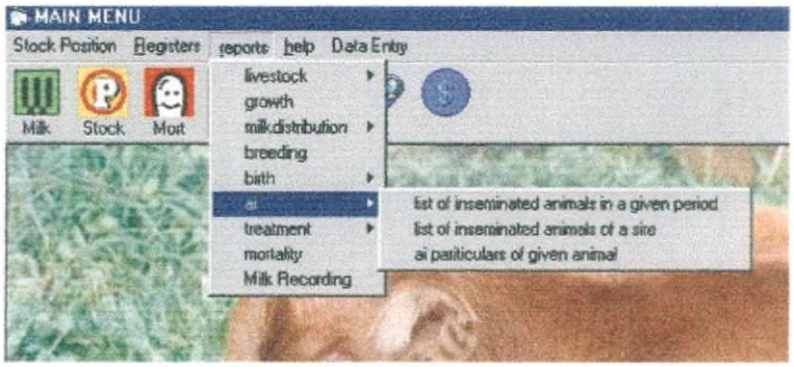


Fig. 14 General

Fig. 15 Reports



birth, date of death, cause of death and remarks as shown in Fig 13. This sub menu is also provided with **Add** and **Delete** options.

4.5.6.9 General

The last option in the submenu registers is **general**. This option could be utilized for displaying any registers of need, by entering the register name in the relevant field and pressing the **Open** option. A message will appear confirming the linking of register. The format for general register is depicted in Fig 14.

4.5.7 Reports

The next submenu in the main menu is reports. This sub menu reports is provided with several options *viz.*, livestock, growth, milk distribution, breeding, birth, A.I., treatment, mortality and milk recording. The submenu reports with its options are depicted in Fig 15. When a particular option is selected, the user is asked to enter the required information. Upon entry, the report will be displayed in a printable screen, the user can directly get a hardcopy of the report also.

4.5.7.1 Livestock report

The livestock option in the sub menu displays the reports regarding list of animals in a given period, list of animals born to a given sire and list of animals born to a dam. Any of the reports could be generated by directing

Fig. 16 Live stock report (List of animals entered the farm)

c147	18/09/01	Deepesh	855	ULF	Died on 29/12/01-haemopr
c149	15/10/01	Deepesh	1135	ULF	Sold on 24/10/01-Bill No:
c150	15/10/01	Deepesh	1149	ULF	
c151	15/10/01	Deepesh	1010	ULF	Sold on 20/11/01-Bill No:
c153	23/10/01	Deepesh	1178	ULF	
c157	02/11/01	Deepesh	c021	ULF	

Fig. 17 Growth report

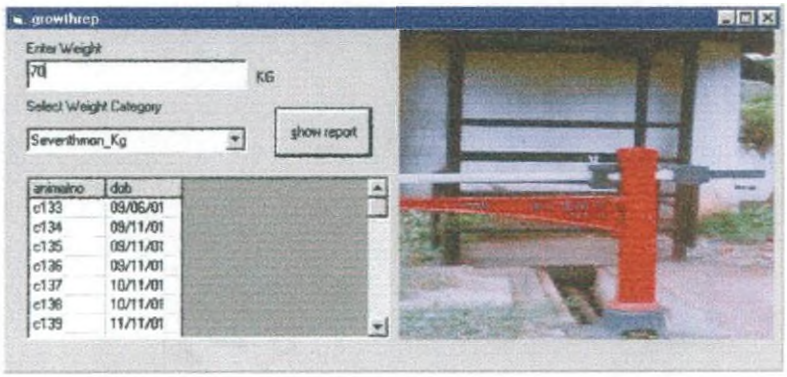


Fig. 18 Milk distribution report

Fig. 18 Milk distribution report

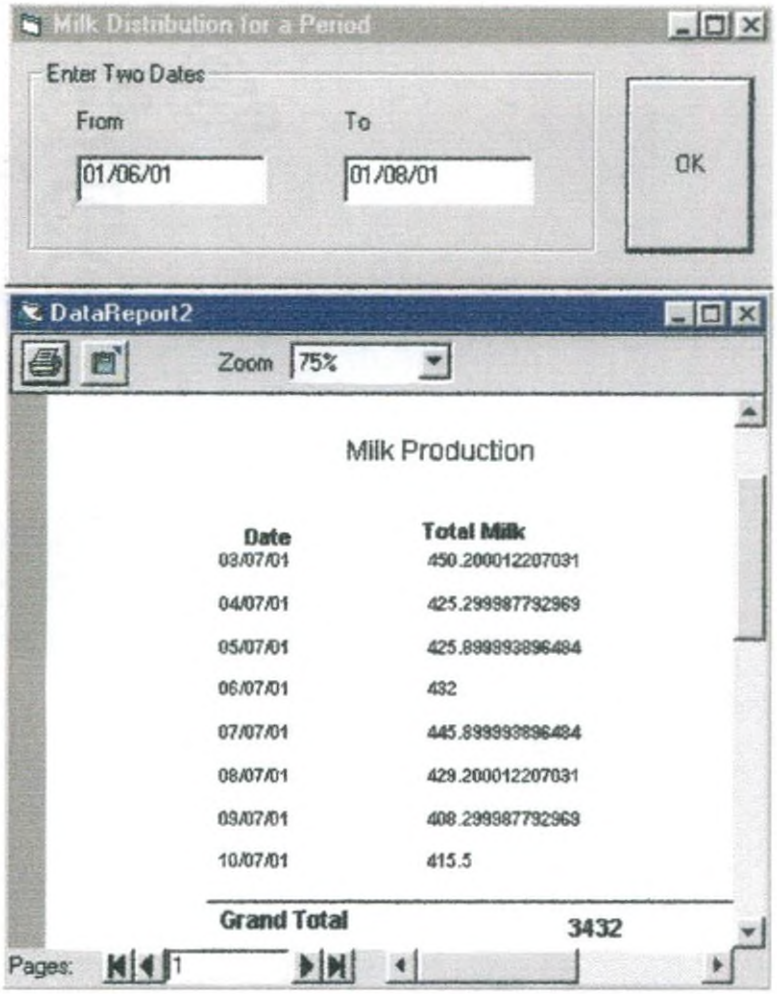
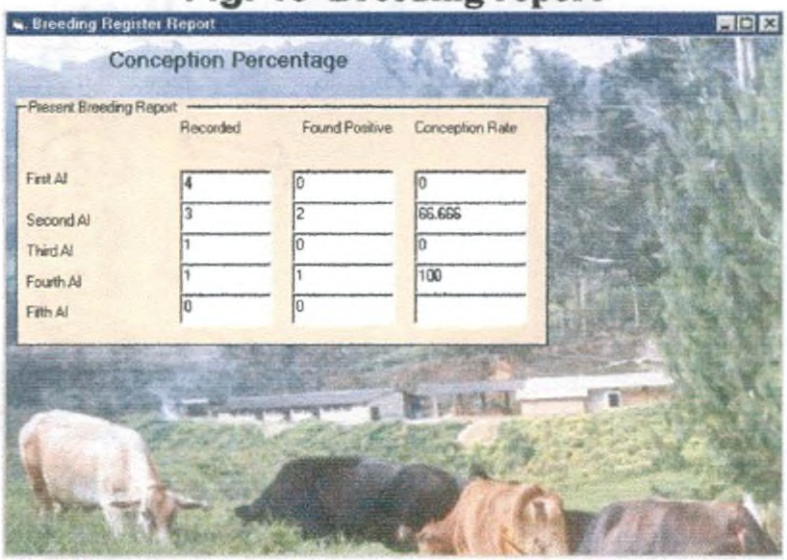


Fig. 19 Breeding report



the cursor over the concerned report and activating it. The model reports samples from livestock register are presented in Fig. 16.

4.5.7.2 Growth report

The second option in the submenu, reports, is growth. This option gives the reports on list of animals that attained more than 100 kg body weight at the age of one year and weight gain at different months. The model reports from growth register are presented in Fig 17.

4.5.7.3 Milk Distribution report

The next option helps the user to get reports regarding milk distribution between two given dates and total milk production in a given period. The model reports from milk distribution register are presented in Fig 18.

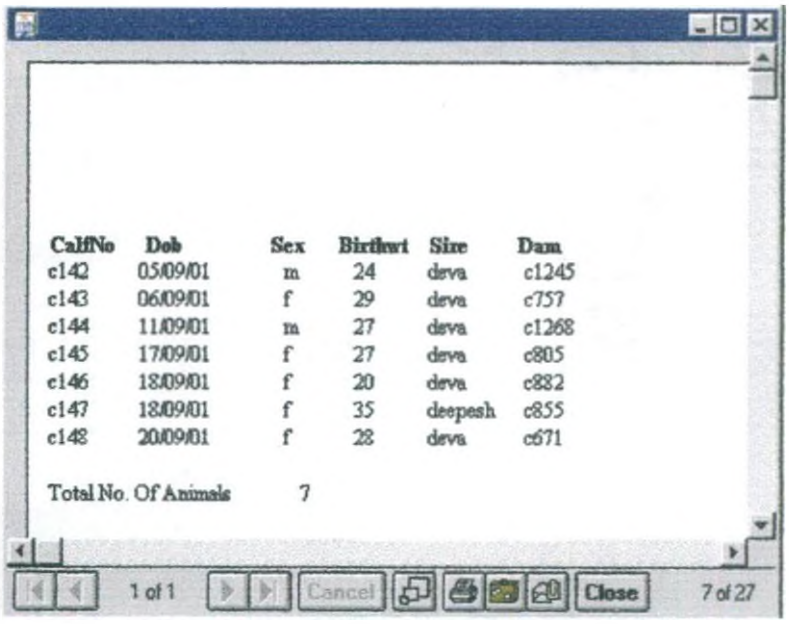
4.5.7.4 Breeding report

The report include number of animals that have not conceived even after five artificial insemination (AI), list of animals that get conceived in first AI, second AI and so on. The model reports from breeding register are presented in Fig 19.

4.5.7.5 Birth report

This option provides reports on list of animals that are born in a given period of time. The model reports from birth register are presented in Fig.20.

Fig. 20 Birth report



CalfNo	Dob	Sex	Birthwt	Sire	Dam
c142	05/09/01	m	24	deva	c1245
c143	06/09/01	f	29	deva	c757
c144	11/09/01	m	27	deva	c1268
c145	17/09/01	f	27	deva	c805
c146	18/09/01	f	20	deva	c882
c147	18/09/01	f	35	deepesh	c855
c148	20/09/01	f	28	deva	c671

Total No. Of Animals 7

Fig. 21 AI Report(List of Animals Inseminated to a Sire)

17/09/0	1242	haidar
22/09/0	843	haidar
23/09/0	1236	haidar
24/09/0	837	haidar
27/09/0	T735,C042	haidar
28/09/0	1297,1009	haidar
29/09/0	1133,1233	haidar
04/10/0	880,T637	haidar
06/10/0	1228	haidar
09/10/0	1242	haidar
10/10/0	1179	haidar

Fig. 22 Treatment Report (List of animals treated)

16/09/01c1272	wound	dressedwith lorexane
17/09/01c862	wound	dressed with lorexane
19/09/01c1272	wound	applied lorexane
20/09/01c855	mastitis	enrox-15mli/v 15mls/c
21/09/01c855	mastitis	enrox-15mli/m
21/09/01c805,c671	mastitis	oxy-30mlLAi/m

Fig. 23 Mortality report

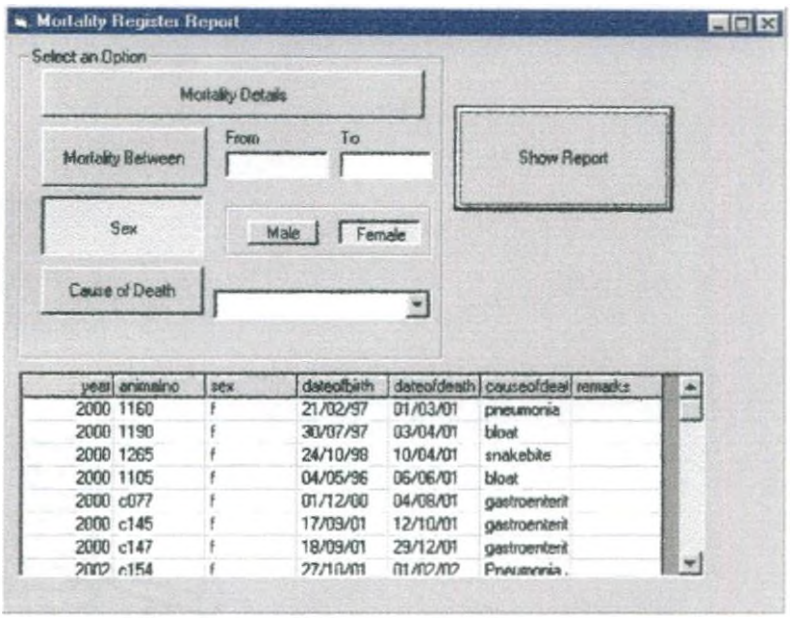
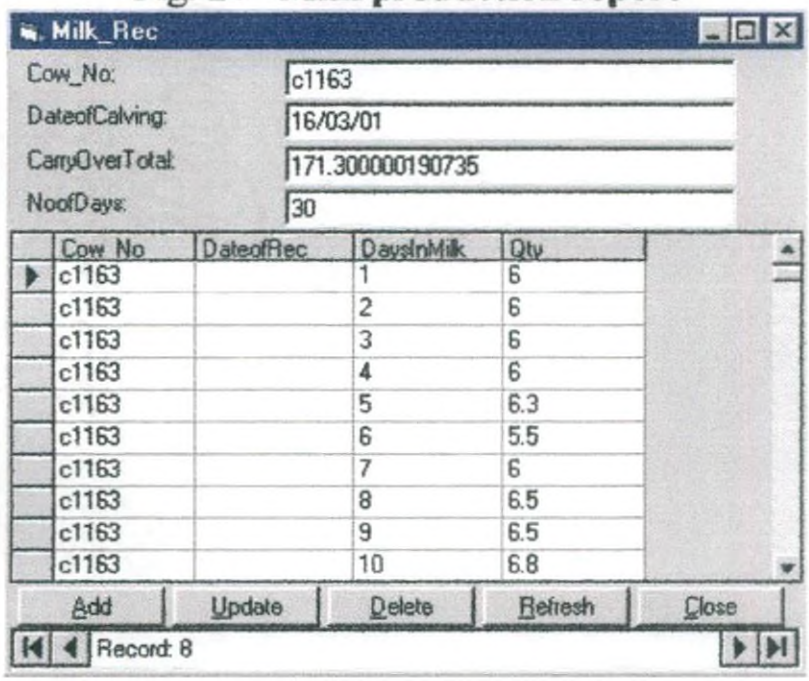


Fig. 24 Milk production report



4.5.7.6 AI report

The fifth option in the submenu reports is AI, which generates reports on list of animals inseminated in a given period, list of animals inseminated to a particular sire and AI particulars of a selected animal. The model reports from A.I. register are presented in Table 21.

4.5.7.7 Treatment report

Reports that could be obtained from this option includes list of animals treated between two given dates, incidence of a particular disease, occurrence of specific disease and its treatment A model report from treatment register is presented in Fig. 22.

4.5.7.8 Mortality report

This option generates reports related to mortality of animals. The reports include mortality that occurred between two given dates, sex wise death occurrence and cause of death. The model report from mortality register is presented in Fig 23.

4.5.7.9 Milk Recording report

The last option in the submenu reports is, reports relating to milk yield of animals. It generates reports about the milk yield of a particular animal between two given dates. The model report from milk recording register is presented in Fig 24.

Fig. 25 Help

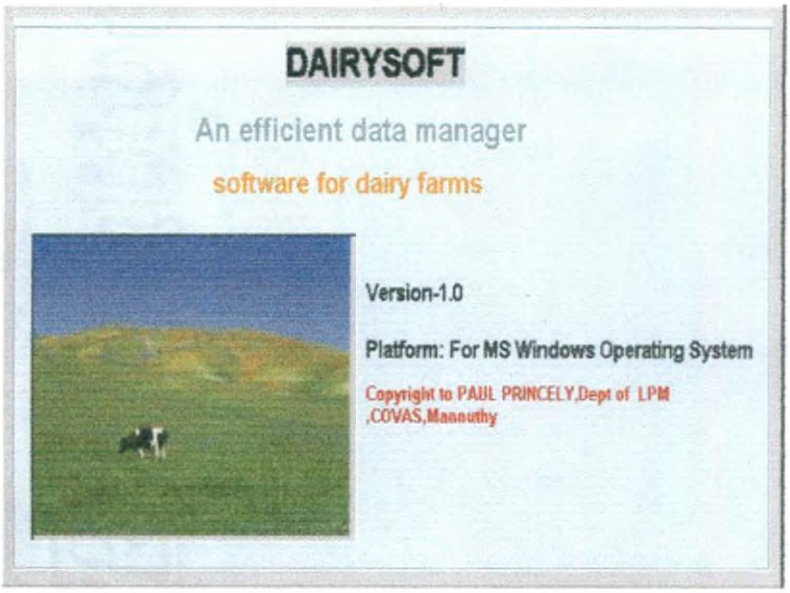
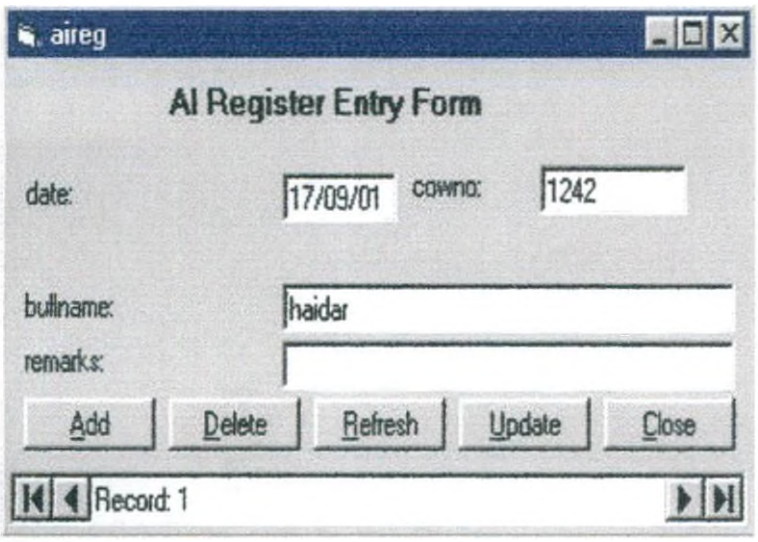


Fig. 26 Data Entry



4.5.8 Help

This submenu describes information about the software such as front-end version, back end version, patent in any of the software and short cut keys. The help page is presented in Fig 25.

4.5.9 Data Entry

This is another submenu, which contains list of registers namely, milk recording register, livestock register, A.I. register, birth register, breeding register, growth register, mortality register, treatment register and milk distribution register. This option was exclusively created for data entry. All the registers are connected with their respective database. Data entered will be stored in the respective database, which will be displayed in the submenu registers. Each register is provided with **Add, Delete, Refresh, Update** and **Close** option. Number of records available in the particular register will also be displayed. Fig. 26 shows the entry format of a register, which is used for entering data.

Table 1. Types of registers and input requirement in manual and computerized recording system

Sl. No.	Registers	Number of inputs in each register	
		Manual	Computerized
1.	Treatment register	7	4
2.	Breeding register	18	3
3.	Growth register	7	4
4.	Milk recording register	11	5
5.	Milk distribution register	14	8
6.	Livestock register	13	7
7.	Birth register	7	6
8.	Artificial insemination register	4	3
9.	Mortality register	9	7

Table 2 Time requirement for data entry in manual and computerized recording system

Register	Manual (seconds)	Computerized (seconds)	T
Treatment register	3.13±1.10	2.63±1.10	4.13*
Breeding register	4.47±1.81	2.98±1.32	5.60*
Growth register	1.19±0.25	0.67±0.10	7.88*
Milk recording register	22.18±1.13	17.37±1.35	8.81*
Milk distribution register	3.70±0.31	2.88±0.19	6.67*
Livestock register	1.81±0.18	0.96±0.07	10.72*
Birth register	1.95±0.19	1.18±0.21	30.44*
AI register	1.46±0.40	0.88±1.4	3.72*
Mortality register	2.55±0.30	1.97±0.19	11.37*

* Significant difference in time taken before and after development of software ($p<0.01$)

Discussion

5. DISCUSSION

5.1 Existing system of data management

Although the University livestock farm simulated a well-organised dairy farm in several aspects, the management system is not free from constraints The University livestock farm has the traditional way of keeping manual records and the recording needs manpower, the deficiency of it created an impasse. Gaines (1989) has listed out the difficulties in traditional record keeping system in farms. The present finding agrees to this in many occasions insufficient and inefficient retrieval of information from animal records culminated in inefficient managerial decisions. Lack of timely knowledge about individual animal details such as stage of lactation, pregnancy status and disease condition often interfered in efficient decision making process in the farm and were the main obstacles for proper care and management of animals. Similar observations were reported by Elmore (1990) and Chang *et al.* (1992).

There have been many constraints and problems encountered while following the traditional record keeping method in the farm (Saha and Kumar, 1999). The farm maintains a number of records, registers and loose leaflets pertaining to various animal and farm events. Most of the entries are repeatedly made in different ledgers, which consume considerable time and energy, besides inviting avoidable errors. The information obtained from these records is difficult to analyse and hence problems are often invisible to

the manager, ultimately affecting the decision-making process. The present observations are also in tune with this.

An experienced employee can reduce the number of mistakes that would arise while doing data entry in records and or recalling information, but the monotonous nature of work brings down his efficiency. As University livestock farm is a quasi-government institution, appointment and transfer of employees is on policy basis rather than need basis. Each transfer or replacement has a cascading effect and employees, new to the farm had to spend more time than needed to get familiar to and accustomed to the records and registers. This observation is in congruence with Putler and Zilberman (1998), who emphasised the relationship between workers ability and productivity.

5.2 Evaluation of Recording System

Table 1 clearly depicted the presence of more input requirement in manual recording system over the computerized recording system. Keeping of traditional input format which consists of more number of unwanted entry and duplication of many entries resulted in requirement of additional man hours for efficient record keeping system.

These schedules and records are scientifically formulated and planned to achieve the desirable objectives of the farm. Feeding schedule is formulated by giving due consideration to the production potential, stage of production, age and type of animal. To follow such a feeding practice, the manager should constantly keep track of the above said parameters, failing

which results in either over-feeding or under-feeding. Due to the inherent difficulty in handling the manual records, certain parameters such as stage of lactation, stage of gestation, body weight of the animal etc., were not taken into consideration, resulting in sub-optimal utilisation of farm resources leading to inefficient production. These are different from the principles laid out in scientific farm management (Package of Practices Recommendations, 2000).

Although breeding records and artificial insemination register were maintained in the farm, the voluminous nature of data and lack of integration among these breeding records often end up in poor decision making in areas of oestrous detection, service timing, drying off animals, and feed allocation. This was in accordance with the findings of Udomprasert and Williamson (1990) in dairy farms. Coupled with these, there are problems such as improper timing of artificial insemination and poor heat detection, which will affect the conception rate resulting in reproductive inefficiency. Ultimately longer inter-calving periods, prolonged service period and extended days open do depict the inefficient reproductive management in the farm. Although a dry period of 60 to 65 days is the standard recommended to be followed in the farm, many a times this is not followed and only a short dry period is allowed. This may be due to non-availability of data from existing records at the proper time and also difficulty in inferring the managemental activities like calving date, AI date etc., from existing records (Package of practices recommendations, 2000).

The primary purpose of record keeping in a dairy farm is to give a detailed set of information on individual animal and the entire herd for day-

to-day decision-making, evaluating post managemental practices and long term planning. Manual record keeping has traditionally been followed in all organised farms. Various records maintained in the farm include stock register, livestock register, Artificial Insemination (AI) register, mortality register, feeding register, breeding register, milk distribution register, calf birth register, weight register and growth register. These registers are used for providing information for general as well as operational, management and technical activities of the farm. These records also form the basis for implementing various policies of the farm for achieving the desired objectives. As realised by Ringwall *et al.* (1992), records are the foundations of the farm management practices.

5.3 Time Requirement

As shown in Table 2 the time taken for manual recording was significantly more ($P<0.01$) than the computerized recording system. The presence of only minimum entries without duplication considerably reduced the time requirement, which was similar to the findings of Chang (1992) and Williams and Ward (1989). It was found out that computerized recording system would be time efficient and time saving when compared to manual recording. Lucey *et al.* (1983) in a similar work reported that only 40 minutes was required per week to process data and to generate reports, whereas in the present observation the time frame was further less. This may be due to the modified input layout of the present software.

5.4 Retrieval of Information

The lesser time requirement for retrieving information by computerized recording system over the manual recording system was due to the fact that it needs to refer a single working sheet and the search mechanism in a computer is very much faster and efficient than manual system.

5.5 Computerised Recording System

5.5.1 Menu system

The developed computerized data management system is designed with a menu system which is the easiest mode of accessing every unit of the program was reported with a menu system by Ko (1992).

5.5.2 Welcome Page

Welcome page is designed as the entry point to the computerized management system and exit point to come out of software. Similar pages are set for other software also (Ko, 1992).

5.5.3 Login Form

A login form is provided, as the computerized records are editable, the login form prevents the unauthorised manipulation of data by the password protection as present in every software program.

5.5.4 Main Menu

The main menu and its submenu's made the program easily accessible, as even non-professionals can operate without any guidance. This main menu and submenu's was designed similar to that of the program developed by Ko (1992).

5.5.5 Stock position

This menu enables the user to view details on animals such as adult stock details, growing stock details and young stock details, number of milch animals, number of dry animals, number of animals under experimental study. The total milk production and average milk production performance of the herd were obtained from milk distribution register. Number of pregnant animals of the farm, which is an important reproductive parameter, is available from this page. This menu is designed to view the herd details as a whole, so as to present the viewer a comprehensive picture on the performance of the dairy herd. This is in congruence with Sard (1981) and Ringwall *et al.* (1992).

In computerized recording system, the stock position worksheet was linked to other worksheets such as breeding register and milk distribution register. Because of this, duplicate entries were avoided which in turn minimises time requirement. This study was in incongruence with the findings of Ko (1992). Total milk production and average milk production

obtainable through the milk distribution register was in accordance with the study of Britt and Ulberg (1969) and Lissemore *et al.* (1992).

In computerised recording system software should be developed with minimum entry and hence less time is required for recording. This is the advantage over manual entry, which requires more time, as all the entries has to be made manually. The developed database enabled rapid access to menu-driven recording system without any loss of data. Similar programs were developed by Williams and Ward (1989) for dairy farms. Presence of 'Registers' option allows the user to view line by line any record of animals and make any appropriate changes necessary for the upkeep of records (Ko, 1992). In the present work also a similar system is followed. The presently developed computerized data management system is flexible and rapid with respect to searching facilities and easy retrieval of information similar to the findings of Thrusfield and Hinxman (1981).

Records in the computerised recording system due to its user-friendliness helps the user to do record analysis frequently whereas manual recording system creates reluctance among users because of improperly maintained records of bulk data and inefficient presentation.

5.5.6 Registers

Revoking the needed information and viewing of any animal details and changes in any part of the animals record details were made easier by the presence of the sub menu 'Registers'. The submenu system for displaying the animal details was similar to the findings of Ko (1992).

5.5.7 Reports

Reports are the crux of the manual records and hence are not generated often in traditional system. Overall herd performance is assessed scientifically by obtaining periodical reports. Much emphasis was given in preparing reports by many workers (Gaines, 1989). Weight gain assessment reports of animals gave a comprehensive idea about growth performance of calves and adult animals which will be helpful for selecting the animals for breeding, genetic evaluation, etc. Similar system of assessment of weight gain in pigs was reported by Pepper (1977). Breeding performance reports will help profitable farming by revealing a broad picture of the breeding problems of the farm (Lissemore *et al.*, 1992). The present observation also points to this fact. Utilising the treatment related reports, the herd health can be maintained by assessing the disease occurrence in the farm in different seasons and comparative efficacy of one treatment regime over the other can be evaluated more easily. This is akin to the report by Lissemore *et al.* (1992). Milk production reports help to assess the lactation performance of each animal and hence, they can be better utilized for effective culling of the unproductive stock in time. This feature is a major handicap in traditional manual recording system.

5.5.8 Help

The help menu, which was designed in the computerized data management, was presented to give a comprehensive details about the farm. This menu was designed similar to the one developed by Ko (1992).

5.5.9 Data Entry

The data entry operators can be employed for entering data by using the sub menu 'Data entry' which is designed exclusively for entering data.

Summary

6. SUMMARY

Although tremendous improvements have been made in dairy sector in terms of productivity and production, there have been instances of avoidable gaps between attainable and attained benefits largely due to inefficient management of dairy farms in India. As the traditional manual system of record keeping has been of little help for effective record management, a system of record keeping that facilitates timely retrieval of information at a faster pace, at the appropriate time for making dynamic decision is the need of the hour. Developing a computerized system to perform data management would be an efficient approach to help farm managers for effective management and performance monitoring. Keeping this in mind, the present study was planned to develop a computerized recording system for dairy farms.

University Livestock Farm, College of Veterinary and Animal Sciences, Mannuthy was selected for the study. The observed data and information were used for analysing the existing system of dairy herd management, problems encountered in the existing system, man-hour requirement for recording were assessed. The input requirements for developing computerized recording system were identified.

Based on these facts, a computerized data management system was developed. The enterprise edition of Visual Basic 6.0 was used as front end and MS Access-97 was used as back end for the program developed.

Computerized recording system was named as 'DAIRYSOFT'. Dairysoft was structured under a main menu with various submenus such as Stock position, Registers, Reports, Help and Data entry. The user would be able to access any register immediately and retrieve the information fast.

The comprehensive information about the dairy herd could be immediately known from the Stock position menu, which requires only minimum data entry.

Registers menu was designed to view any registers for retrieving any information and for editing changes.

As reports were the main tool, which helps to identify the lacunae and defects in the dairy management system, reports menu was designed in such a way that all the necessary reports from every register could be immediately obtained.

The help menu designed could be utilised for getting information about the software. A separate data entry menu was created exclusively for entering data.

The man-hour requirement for entering data by manual recording system for treatment, breeding, growth, milk recording, milk distribution, birth, AI and mortality registers were 3.13±1.10, 4.47±1.81, 1.19±0.25, 22.18±1.13, 3.70±0.31, 1.81±0.18, 1.95±0.19, 1.46±0.40 and 2.55±0.30

minutes respectively, whereas, the man-hour requirement for entering data by computerised recording system for treatment, breeding, growth, milk recording register, milk distribution, birth, AI and mortality registers were 2.63±1.10, 2.98±1.32, 0.67±0.10, 17.37±1.35, 2.88±0.19, 0.96±0.07, 1.18±0.21 minutes respectively. The variation in the man-hour requirement between manual and computerised data management system was found to be significant ($p<0.01$).

From the above study, it could be observed that the program developed provides easy recording of data, timely retrieval of information and necessary reports that could be used to evaluate the efficiency of the farm. It reduces the man-hour requirement significantly. Therefore, it may be concluded that computerized data management system would be advantageous, effective and time saving than manual data management system for dairy farms.

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COMPUTERIZED DATA MANAGEMENT FOR DAIRY FARMS

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ABSTRACT OF A THESIS

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ABSTRACT

Dairy farms play an anchor role in the development of dairy sector and in turn sustainable milk production. Efficient farm management inevitably requires proper data management. As the traditional recording system seems to be disadvantageous, computerized data management system is gaining importance for efficient record management. So, the present study was planned to analyze the existing system of record management and to develop a computerized record management system for dairy farms.

The study was conducted in the University Livestock Farm, College of Veterinary and Animal Sciences, Mannuthy. The existing system of data recording was analyzed. The input requirement in both manual and computerized recordings were observed. The time required for recording data, both in manual and computerized recording system were measured. Based on the results obtained by the assessment of existing recording system, the input requirement for computerized recording was identified.

By incorporating these inputs, the computerized data management system 'DAIRYSOFT' was developed using visual basic 6.0 as front end and MS Access as back end program. From the study, it was found out that manual recording system consisted of many unnecessary entries and duplication of entries. The number of entries to be made for a single recording in the manual recording system was considerably more than that of computerized recording system. The time taken for retrieval of information required screening of two

to three registers whereas, computerized recording system required a single worksheet.

The man hour requirement for entering data in manual recording system for treatment, breeding, growth, milk recording, milk distribution, birth, artificial insemination (AI) and mortality registers were 3.13 ± 1.10, 4.47 ± 1.81, 1.19 ± 0.25, 22.18 ± 1.13, 3.70 ± 0.31, 1.81 ± 0.18, 1.95 ± 0.19, 1.46 ± 0.40 and 2.55 ± 0.30 minutes respectively; whereas the man-hour requirement for entering data by computerised recording system for treatment, breeding, growth, milk recording register, milk distribution, birth, AI and mortality registers were 2.63 ± 1.10, 2.98 ± 1.32, 0.67 ± 0.10, 17.37 ± 1.35, 2.88 ± 0.19, 0.96 ± 0.07 and 1.18 ± 0.21 minutes respectively. The variation in the man-hour requirement between manual and computerised data management system was found to be significant ($p<0.01$).

The computerized data management system is a user-friendly programme. It is based on menu system, which is protected with a password. The programme consists of main menu and several submenus namely stock position, registers, reports, health and data entry. Each submenu is provided with several options. Submenu stock position describes the present day stock position of different categories of animals and other details such as total milk production and number of pregnant animals available presently. Submenu 'registers' allow the user to view all the registers of the farm. The user can retrieve any information from different registers using the options available, which displays the concerned register. Submenu 'reports' allow the user to

obtain various reports required for analyzing the efficiency of the farm. The user can directly take hard copy of the report. The submenu 'help' gives information about the software and the last submenu was exclusively formatted for data entry.

From the study, it may be concluded that the developed computerized data management system may ensure effective recording in dairy farms, timely retrieval of needed information, generate important reports that are useful for managing and evaluating the efficiency of the farm.