# COMPUTERIZED DATA MANAGEMENT SYSTEM FOR GOAT FARM


By

**S. RAJENDRAN**

## THESIS

**Submitted in partial fulfilment of the requirement for the degree of**

## Master of Veterinary Science

**Faculty of Veterinary and Animal Sciences**
**Kerala Agricultural University**

**Department of Livestock Production Management**
**COLLEGE OF VETERINARY AND ANIMAL SCIENCES**
MANNUTHY, THRISSUR - 680651
KERALA, INDIA

**2002**

# DECLARATION

I hereby declare that this thesis entitled **"COMPUTERIZED DATA MANAGEMENT SYSTEM FOR GOAT FARM"** 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.

19.10.02

Mannuthy

**S. RAJENDRAN**

# CERTIFICATE

Certified that the thesis entitled **"COMPUTERIZED DATA MANAGEMENT SYSTEM FOR GOAT FARM"** is a record of research work done independently by **Dr. S. Rajendran**, 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.

19/10/02

**Dr. P.C. Saseendran**
(Chairman, Advisory Committee)
Professor and Head
Department of Livestock Production Management
College of Veterinary and
Animal Sciences, Mannuthy

Mannuthy

# CERTIFICATE

We, the undersigned members of the Advisory Committee of **Dr. S. Rajendran,** a candidate for the degree of Master of Veterinary Science in Livestock Production Management, agree that the thesis entitled **"COMPUTERIZED DATA MANAGEMENT SYSTEM FOR GOAT FARM"** may be submitted by Dr. S. Rajendran, in partial fulfilment of the requirement for the degree.

19/10/02

**Dr. P.C. Saseendran**
Professor and Head
(Chairman, Advisory Committee)
Department of Livestock Production Management
College of Veterinary and Animal Sciences, Mannuthy

**Dr. Francis Xavier**
Associate Professor
Department of Livestock
Production Management
(Member)

**Dr. P. Nandakumar**
Associate Professor and Head
University Sheep and Goat Farm
(Member)

**Mr. P.J. Boniface**
Assistant Professor
Department of Computer Science
College of Co-operation and Banking
(Member)

30.11.2002

**External Examiner**

Dr. V. Ramesh Saravanakumar
Associate Professor & Head
Dept. of Livestock Production & Management
Veterinary College and Research Institute
Namakkal - 637002

## *ACKNOWLEDGEMENT*

*I would like to express my unreserved gratitude and indebtedness to* ***Dr. P.C. Saseendran****, Professor and Head, Department of Livestock Production Management and my outstanding mentor. The incessant support is something which words or deeds can not thank. The personal attention, persuation and incessant help rendered in all possible ways throughout the course of my study was the major factor that helped me in my accomplishment.*

*I am grateful to* ***Dr. Francis Xavier****, Associate Professor, Department of Livestock Production Management for his timely help and critical and constructive review of my manuscript.*

*There are no words to pay my respect and gratitude to* ***Dr. P. Nandakumar****, Associate Professor and Head, University Sheep and Goat Farm, Mannuthy, for his words of inspiration, kindness and professional guidance during the entire period of research.*

*I sincerely acknowledge the support and whole hearted co-operation extended by* ***Sri. P.I. Boniface****, Assistant Professor, College of Co-operation and banking.*

*I am also grateful to my other teachers in the Department of Livestock Production Management,* ***Dr. K.S. Sebastian, Dr. Leena Anil, Dr. K.S. Anil*** *and* ***Dr. Kannan*** *for much of their help in various tangible and intangible ways.*

*I thank the* ***Dean****, College of Veterinary and Animal Sciences for providing necessary facilities for the study.*

*I am indeed thankful to* ***Sri. Israel Thomas****, Assistant Professor, Extension Training Institute, Mannuthy for his kind help, valuable advice and timely assistance given to me.*

*love for his brotherly, ever helping attitude, incessant inspiration and mature, supportive dealings.*

*I wish to place on my record my deep sense of gratefulness and indebtedness to* ***Suresh****, for lending me his technical and material services.*

*I sincerely thank my beloved colleagues* ***Bindu, Paul, Sasi, Vivek, Geetha*** *and* ***Deepa Jacob*** *for making this thesis programme a memorable one.*

*The invaluable help and moral support rendered by my fellow PG's* ***Sasikumar, Vimal, Bala, Prasanna, Kowsig, Chintu, Babitha, Thiriveni, Bisi, Sajitha, Deepa, Binduraj*** *and* ***Shameem*** *are appreciated. Thanks are also due to* ***Ambika, Sakthi, Sekar, Madan, Raja, Hari, Siva, Fakrudeen,*** *Jeeva and* ***Chitra Joseph****.*

*I sincerely thank to* ***Dr. P.X. Antony, Dr. P. Senthilkumar, Dr. K.M. Sakthivel, Dr. S. Ravi, Dr. Vijayakumar, Dr. Rajkumar, Dr. Kantharaj, Dr. Biju, Dr. Harikumar, Dr. Reddy, Dr. Muraly, Dr. Madhukumar, Dr. Vijayabharathi*** *and* ***Dr. Jithendrakumar*** *for their guidance provided.*

*A special thanks to* ***Chitra****, for her care and encouragement throughout the course of study.*

*Thanks are also due to the farm Assistants* ***Majeed, Vasudevan*** *and* ***Usharani*** *and all other workers at the University Sheep and Goat Farm and non-teaching staff of Department of Livestock Production management.*

*I gratefully acknowledge the whole hearted help rendered for developing computer programme by* ***Meenakshi Sundram, Raja, Suresh*** *and* ***Thirupathi****, Erode.*

*I appreciate with thanks, the care and skill with which the typing and compiling of thesis was done by* ***O.K. Ravindran****, C/o. Peagles, Mannuthy.*

*I am thankful to Kerala Agricultural University for awarding me the fellowship for the post-graduate study.*

*I could never thank my parents* ***Sri. Subramaniam*** *and* ***Smt. Vasanthi*** *and brother* ***S. Venkateshwaran*** *and other family members,* ***Chenniappan, Marayammal, Nagammal, Rajasekharan, Santhi, Revathi*** *and* ***Kalavathi*** *enough for their unconditional love, enormous encouragement and for sharing all ups and downs, among many other things.*

*Above all, I bow my head before God, almighty for the blessings showered on me.*

***S. RAJENDRAN***

*With Fond Memory of*
*Chenniappa Gounder, My Grandfather*

***Dedicated To***

***My Beloved Parents and Brother***

# CONTENTS

# LIST OF TABLES

# LIST OF FIGURES

# *Introduction*

# 1. INTRODUCTION

Livestock has played a crucial role in the development and progress of mankind. It provides human-being with food, energy, clothing and nutrition besides helping in transport and agriculture activities. It has also been a mute company to human. Livestock in India is an integral part of agriculture and plays an important role as a backbone of the rural economy. Sastry *et al.* (2000) reported that livestock produced 74.7 million tonnes of milk, 30.2 billions of eggs, 45.5 million kgs. of wool and 4.42 million tonnes of meat.

Goat is the earliest ruminant and the second animal, only after dog to be domesticated by man. Goats are popular mainly on account of their short generation intervals, higher rates of prolificacy, and the ease with which the goats as also their products can be marketed. Goats are potential source of meat, milk, skin, fibre, manure, valued as laboratory animals and are also used for hauling light load (Prasad, 2000). It has the synonym "poor man's cow" because of their immense contribution to the agrarian rural economy. It contributed Rs.2,443.3 crores per annum to the national economy which was 10.1 per cent of income accrued from livestock sector (Amle and Mhase 2001). The current goat population is estimated to be around 128 million (1999-2000) and it has been estimated that the goat population may reach a figure of 137 million by 2005, where it may stabilize. The current mean rate of slaughter of goats is around 41 per cent and the mean rate of mortality, around 15.5 per cent. The 410 million kg of goat meat represented almost 37 per cent of total meat

produced in the country, although 1900 million kg of milk represented only around 3 per cent of the total milk produced. Among other products skin amounted to 100.9 million kgs, pashmina to 30 metric tonnes and manure estimated around 35,000 metric tones (Pant, 2001).

Though considerable improvements have been made to raise profitability in the livestock sector by augmenting the productivity of animals, there have been instances of avoidable gaps between attainable and attained benefits, largely because of the productivity differences between farms. It has also been noted that some farmers secure obviously higher yields than others, with the same resources indicating that management factor accounts for these variations (Dekkers, 1991). These differences lead to reduction in the potential benefits that could be obtained from animals. The augmented productivity of animals fails to get transformed into tangible benefits mainly because of the improper farm management. Hence, management is becoming increasingly important in livestock farming.

Farm management deals with the ways and means of organizing the production factors including land, labour and capital and the choice of crop and livestock enterprise to ensure maximum return (Pandey, 1997). Good management undertakes the breeding, feeding, heeding, weeding and reproduction practices in an efficient manner, which is important in making livestock farming economical. Good records are the foundations of good management (Furman and Hughes, 1992). The control of productivity will be a guesswork if records are not maintained properly. Hence more emphasis

should be given to maintain timely, precise, accurate and adequate data or information regarding various activities of goat farm.

Manual record keeping is a tedious and time consuming process and the data stored in the manual records could only be converted into information through complex calculations. It leads to poor and delayed decision-making process leading to economic inroads. Conventional record keeping requires repeated data entry in different registers, which occupy space, besides inviting errors at the time of data recording and these errors are often unnoticeable. Manual record keeping requires personnel with more experience and skill to avoid errors in the data recording. The absence of skilled persons may be lead to more complications in the data recording, as replacing an experienced staff is time consuming and is almost practically unfeasible. Inaccurate and irregular records, make it impossible to ascertain how the farm is performing and prevent timely correction of any management problems that may persist (Basheer, 2001).

A quality management can be brought through the use of computerized records (Esslemont and Kossaibati, 2000). In the recent years, computer has become an important farm management tool and a new management resource. The past decade had seen the rapid adoption of computer technology in many facets of veterinary field. Programs are now, in common use in both veterinary practice and farm management. As new computer programs are developed, more computers become accessible and farm managers learn more about how to use the computer. Hence, computer can be used in farm management to

substitute record keeping activities of the farm and to increase accuracy, speed, diligence and efficiency of budgeting and analysis of previous year records.

Realizing the undeniable significance of computerization in farming operations and recognizing the potential popularity and growth of goat farming in India, every attempt has to be made to introduce computerized management into goat farming. The studies regarding computerization in goat farms are very meager.

Hence, the present study was carried out in Kerala Agricultural University Sheep and Goat farm to introduce computerized data management system with the following objectives:

1. To evaluate the shortcomings in the existing data management system.
2. To develop computerized data management system.
3. To evaluate merits and demerits of computerized data management system with that of the existing system.

# *Review of Literature*

# 2. REVIEW OF LITERATURE

A review of concepts used in past studies has been employed to clearly define the concepts used in the present study and to view the associated problems in proper perspective. The information regarding the present study are scanty due to its infant stage. In this chapter, the available literature in relation to Data management, Computers in data management, Computers in farm management and Data management systems in India have been reviewed.

## 2.1 Data management

### 2.1.1 Management

The basis of good management depends on the provision of precise, up-to-date information, so that sound decision on management could be made. Provision of this information requires systematic record keeping and prompt and intelligent analysis of those records (Blood, 1979). Hutt and Hutt (1993) defined management as a comprehensive activity, combining and co-ordinating human, physical and financial resources to produce and market a produce or service effectively and efficiently and hence, it is concerned with planning, organizing, staffing, directing and controlling resources towards accomplishing established objectives and goals.

### 2.1.2 Database

Data is the raw material to be processed by a computer, consisting of characters, fields, records and files. (Capron and Williams, 1982) and a

database provides a way of finding information quickly and easily based on a chosen reference point (Cowart, 1986 and Coutts, 1998).

Hence, database could be defined as a collection of all tables and other objects (such as forms and reports) used to manage data (Simpson and Robinson, 1999).

Visual Basic makes it easy to programme the connectivity to a database or user graphical controls to set up the data display and modification and it contains a complete database system that can be used to store and retrieve information quickly and easily (Rahmel, 1999 and Winemiller *et al.*, 1999).

### 2.1.3 Database management system

Capron and Williams (1982) defined database management system as a set of programme that provide access to a database via application programme or query languages.

A good computerized database management system serves not only as a repository for data, but it allows selective extraction of data, meeting specific criteria (Cowart, 1986) and it forms the foundation for products that generate applications and extract data (Perry and Lateer, 1991). In essence, the information that was physically stored into the database is recalled by a special programme known as a database management system (Petroutsos, 2000).

## 2.2. Computers in data management

The effective production of management data is definitely one of the best uses of computerization in veterinary practice today (Farber, 1989) and a microcomputer-photocell system was developed in the University of Maryland (Erez and Hartsock, 1990) to record, summarize and transfer data on the postural changes of crate-confined sows. Pharo *et al.* (1990) conceived a data management system, based on the database programme "Panacea", for use in small holder dairy farms in Malaysia with respect to data collection, entry and analysis.

Lissemore *et al.* (1992) described the implementation and use of a micro computer based herd management information system to monitor dairy herd performance in South Western Ontario while Lees *et al.* (1993) developed 'CRITTER', a computer database programme for the management of research animals in Canada. Schmisseur and Gamroth (1993) evolved 'DXMAS', an expert system programme for the analysis of annual economic and production performance data provided by dairy operators of Tillamook county, Oregon.

'Dairy-base' developed with data base management system technology, for the management of animal inventory, reproduction, genetic improvement, feeding, milk production and health records of dairy cattle in Israel was described by Spahr *et al.* (1993) and Murdick *et al.* (1994) emphasized the role of computers in storing and processing the data and providing information for decisions as well as for planning and controlling operations.

Bhatt *et al.* (2000) suggested the use of computers in veterinary science for keeping voluminous data and statistical analysis in the recent years.

## 2.3. Computers in veterinary practice

Many veterinary practices today have computer systems and use them quite effectively to assist in the management of the business.

Veterinarians in USA tended to hold generally positive attitudes toward the use of computers and seemed to be aware that computers hold required potentials for effective and productive management of their practices (Dye *et al.*, 1994).

Most of the veterinary practitioners in UK adapted to use the internet in their everyday working lives (Gerrard, 1998a) and websites exist worldwide which provide information, contacts, help and discussion forums for members of the veterinary profession (Gerrard, 1998b). Gerrard (1998c) reported that 98 per cent of practitioners were familiar with the concept of internet in UK, signifying the interest among the veterinary profession in technological developments which was a positive indicator for internet use by veterinarians in the future.

Bhatt *et al.* (2000) pointed out the use of computers in veterinary science as inevitable in recent years. The uses of computers for field veterinarians in farm management least cost rationing, feed analysis, disease prevention, disease diagnosis, accounting etc., were listed out by Thirunavukkarasu (2000).

Hence, the use of practice management software is fast becoming an established part of the daily life of a vet (Gerrard, 2001).

### 2.3.1 Hospital administration

Sard (1981) reported the application of computers in client management by UK veterinary practitioners and computerisation allowed most veterinary hospitals to utilize their existing staff more effectively doing less repetitive jobs with greater satisfaction all round (Barrow, 1995). The role of computer-based practice management system in veterinary hospitals of USA was discussed by Palazzolo (1996).

Coutts (1998) substantiated that veterinary practitioners used their computers on a much wider scale – for example, for integrated storage of client information, stock control, managing appointments and producing personalized client information letters in hospital management. Boydell (2000) emphasized the importance of computers in veterinary hospitals.

Computers would be a boon for hospital administration, case sheet record maintenance, retrieval for follow up action, diagnosis, dispensing medicines, problem solving, etc. (Thirunavukkarasu, 2000).

### 2.3.2. Clinical diagnosis

Computer aided diagnosis is an important aspect of veterinary decision support, because diagnosis is usually the first and critical step in patient management. Many medical diagnostic aids involve computer controls or links to outside computers.

Vos *et al.* (1990) designed an expert known as 'The Electronic Pig' (TEP), which was used to find out the problem, if any, with litter size or still birth, to arrive at a diagnosis of the cause of the problem, and to suggest a remedy for it. Bennett *et al.* (1991) developed a software, 'LYNX' for disease diagnosis and health monitoring in wild mammals, birds and reptiles in London.

A micro computerized programme 'DIAG' was designed by Hanks *et al.* (1994) for the use of regional and national animal disease diagnostic laboratories in Indonesia. The large storage capacity of a computer database could store all the differential diagnostic data and it makes this information useful to clinicians or laboratory technicians. Based on this analogy, a computer programme was developed in India for the identification of oocysts, eggs and larvae by Bandyopadhyay *et al.* (1996)

Heald *et al.* (2000) opined that a diagnostic computer models could be used to broadly classify causes of mastitis with the help of field survey and McKendrick *et al.* (2000) reported the aids of a software programme 'CaDDiS' (Cattle Disease Diagnosis System) in diagnosing tropical bovine disease. 'COWCARD', a diagnostic search programme for cattle diseases and PROVIDES, a programme in which when clinical signs are entered, the programme generated a list of differential diagnosis in order of probability and lists of relevant diagnostic tests were elaborated by Thirunavukkarasu (2000).

### 2.3.3. Data recording and analysis

Computer technology in veterinary medicine offers many advantages of electronic data storage and use. Beland *et al.* (1981) developed a relatively inexpensive microcomputer system to store and manipulate clinical data and pathological data.

Martin *et al.* (1982) reported that a software, 'VIRUS' (Veterinary Investigation Recording Use System) was capable of storing, monitoring and analyzing previous and current records and application of computer technology to the collection, analysis. Use of veterinary data was explained by Thrusfield (1983a,1983b and 1985). The usefulness of a programme known as 'DairyComp 305' was reviewed by Goodger (1987). This dairy software package was extensively used as an on-farm system in California dairies for data analyzing and reporting.

Frankena *et al.* (1990) reported the assistance of 'EPISCOPE', a computer programme in veterinary epidemiology to assist both the teaching of epidemiology. The analysis of field data in the dairy herds of the Netherlands and Barrow (1995) listed out the applications of computer to store client and animal records, clinical history, treatment history and laboratory records.

Sood and Kaur (2000) explained the contributions of computer towards better understanding of biological mechanisms at molecular level by facilitating regular updating and analysis of sequence of data, which proved useful in improving animal productivity

### 2.3.4 Disease monitoring and surveillance

A computer application 'LYNX' programme, greatly facilitated the welfare and veterinary care of animals maintained in captivity for conservation and assisted the monitoring of the health status of free living wild animals (Bennett *et al.*, 1991). Collins and Morgan (1991) developed an epidemiological model of paratuberculosis in dairy cattle and Menzies (1992) also formed a microcomputer model for predicting output from beef suckler herds.

Lees *et al.* (1993) reported that 'CRITTER', a database for managing research animals could be used to monitor disease outbreaks and Ekesbo *et al.* (1994) developed a disease monitoring system for dairy herds. Reid *et al.* (1996) made a computer based user interface for the delivery of epidemiological models and associated information by using hypertext technology and Gobar *et al.* (1998) designed a programme for surveillance of causes of death of dogs, using the internet to survey small animal veterinarians in USA.

Bhatt *et al.* (2000) explained the applications of computers for collecting data regarding available diseases among sex, breed, season and age groups and by this disease prevalence/occurrence could be classified by which outbreak of any emerging disease and its occurrence could be monitored.

## 2.4 Computers in farm management

Management is becoming increasingly important in today's livestock farming. Management information systems can be efficient tools for better management in the farms.

Chandler and Martin (1975) and Speicher (1981) probed the potential for computerization within dairy herd and farm management and speculated in the forms in which computer-assisted management systems might be employed to maximize managerial output. A programme 'DairyCHAMP' was created by Williamson and Udomprasert (1989) in the University of Minnesota, USA aided the farm management in the areas of reproduction, nutrition, disease monitoring and milk production recording. Schmisseur and Gamroth (1993) designed an expert system, 'DXMAS' to diagnose dairy management problems and the field tests identified as management problems in the Tillamook country, Oregon.

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 were useful for decision makers and farm managers. Mourits *et al.* (1999) reported that for maximizing the profitability, the farm managers needed an insight into the potential input of their management decisions on technical performance.

Computerised Veterinary Support system aided the veterinarians in all areas of veterinary decision-making and livestock management (Thirunavukkarasu, 2000).

### 2.4.1 Dairy farming

The computerization of various systems helped in providing timely information for keeping efficient control over the affairs of the dairy and implementation of modern management techniques (Das, 1986) and Goodger (1987) reported the use of a dairy software Package, DairyComp, was extensively used as an on-farm system in California dairies.

Lazarus and Smith (1988) and Cleary *et al.* (1999) reported the use of computers in dairy farm. Mueller (1989) pointed out that the computerization could increase the dairy practitioner's involvement in management and production decisions and Chang *et al.* (1992) developed a microcomputer-based system, 'Compares' (Computerized Milking Parlor Evaluation System) for studying the milking parlor operations in the Cornell University, New York.

Lissemore *et al.* (1992) described the implementation and use of a microcomputer based herd management information system to monitor dairy herd performance in South Western Ontario. Microcomputers increased the efficiency and timeliness of the informations produced and thus, the creation of dairy herd management software programme for specific uses was made possible (Hutt and Hutt, 1993).

Pietersma *et al.* (1998) reported that computerized information systems potentially helped the dairy producers of Canada to deal with the increased complexity of decision making and availability of information in dairy farming.

Recent advances in information technology enabled in-time recording and management support of individual cows (Asseldonk *et al.*, 1999). Fraser and Cordina (1999) described Data Envelopment Analysis (DEA) as a useful tool to assess the technical efficiency of dairy farms in Australia and Kerr *et al.* (1999) designed a combination of decision support system and expert system 'DAIRYPRO', which could be run by dairy extension officers as a consultation package for farmers.

**2.4.2. Feeding**

A computer programme was developed by Stallings *et al.* (1985) in Virginia University to calculate the contents of dry matter, crude protein, total digestible nutrients, acid detergent fibre, cost, macro-minerals and micro-minerals of the ration. Galligan *et al.* (1986) reported the use of an interactive computer programme for evaluation and formulation of ration. This programme, with five sections namely nutrient requirement, feedback, computational feeding, recipe and a comparative economic evaluator was intended for both lactating and non lactating cows.

Ely *et al.* (1991) designed a computer programme to calculate the economic replacement value of feeds and the results were compared with both Morrison values and competitive prices, from linear programming solutions in

the University of Georgia, Athens. Maltz *et al.* (1991) and Maltz *et al.* (1992) opined that computerised dispensing of concentrates could economise the consumption of concentrates, when grouping and feeding of different total mixed rations were impossible.

'Dairy-base', an electronic individual animal inventory and herd management system was developed in Israel by Spahr *et al.* (1993) that comprised of feed database containing nutrient values for all feed stuffs used in all rations fed. The ration fed at a specific locations composed of any feeds in the feed database without regard to the use of a feed at other locations.

Importance of computerized feeding management in dairy herds was also described by Devanand (1995), Schofield *et al.* (1998) and Basheer (2001) and a multimedia case simulation computer programme was developed by Dascanio *et al.* (1997) in USA for delivery of veterinary nutritional case studies.

### 2.4.3 Production

The use of computers as a management aid by dairy producers resulted in great advances being made in production and in the genetic potential of the dairy cow.

During the 1970's, several computer based data handling systems were developed. They were intended to supplement production information received from the Dairy Herd Improvement Programme (Erb *et al.*, 1975) and

Esslemont *et al.* (1981) reported the use of a mini computer system, 'DAISY' in recording production data in the Netherlands.

Several authors elaborated the uses of computerized management system for poultry production (McIlroy *et al.*, 1988; Schmisseur and Pankratz 1989) for pig production (Kilpatrick and Walker, 1990), for beef production (Ringwall and Boggs, 1992; McGrann and Rupp, 1992 and Menzies, 1992) and for dairy cattle production (Devanand, 1995 and Basheer, 2001).

In Israel, a microcomputer application programme, 'Dairy-base' utilized electronic transfer of milk production data from electronic milk meters with the capability to minimize manual entry of other data by electronic updating of the data base (Spahr *et al.*, 1993), while the production section of 'CRITTER', a database for managing research animals was designed by Lees *et al.* (1993) to store information about animal performance such as body weight, body condition score and weaning weight in France.

Lescourret *et al.* (1993) designed a database monitoring systems to monitor production performance of dairy herds. Hayes *et al.* (1998) developed 'DairyMAN', a computer programme being operated as an on-farm Management Information System by herd managers and veterinarians to monitor production performance of New Zealand dairy herds.

**2.4.4. Reproduction**

Meek *et al.* (1975) described the capability of a computer programme to analyse the reproductive efficiency of a dairy herd while Lineweaver and

Spessard (1975) developed a computerized reproductive management programme to provide the dairyman with a current and complete reproductive record on each cow and heifer of Virginia dairy herds. The use of a programme developed in the West of Scotland Agricultural College, named 'VIRUS' in fertility analysis was described by Martin *et al.* (1982).

A computerized dairy reproductive herd health programme designed by Elmore (1990), which interpreted the information from barn report of dairyman and palpation results of veterinarian about the cervix, uterus and ovaries while Erez and Hartsock (1990) designed a micro computer photocell systems in the University Maryland for crate–confined sows to predict farrowing time which enabled the user to monitor the progress of a sow towards parturition without making frequent visits to the farrowing area.

Ko (1992) developed a herd health computer programme which provided a detailed herd health reproduction summary and economic analysis was done comparing current values with performance targets and the practice average. Ko and Stalheim (1992) monitored reproductive parameters and compared these parameters with those of other dairies by using a computer.

Events such as births, breeding, pregnancy diagnosis and semen evaluations could be entered in the reproduction section of a database 'CRITTER' that was designed by Lees *et al.* (1993) in London. Schmisseur and Gamroth (1993) developed an expert system programme 'DXMAS' in USA to provide reproductive management advice to dairy farmers and Spahr *et*

*al.* (1993) described the use of micro computer application in the breeding management of Israelian dairy herds by developing an electronic individual animal inventory and herd management system named 'Dairybase'.

Plaizier *et al.* (1997) used a stochastic model in a computer simulation programme to increase the reproductive performance of USA dairy herds. Herd managers of NewZealand dairy herds used 'DairyMAN', a computer programme for monitoring reproductive performance of their herds (Hayes *et al.*, 1998) and Seegers *et al.* (1999) used computerized monitoring and decision support to improve reproductive performance of dairy herds in France.

Esslemont and Kossaibati (2000) explained the use of databases to manage fertility of dairy herds in UK and Thirunavukkarasu (2000) reported that evaluation of herd fertility could be done by using the measurements like non-return rate to first insemination, calving interval and calving index, calving to first service and overall pregnancy rate with the help of computers.

Wergel and Lin (2000) reported that a computer mate selection programme could be helpful to reduce inbreeding of Holstein and Jersey cattle and to increase farm profitability and Basheer (2001) narrated the application of computerization in the reproductive management of a dairy herd.

### 2.4.5 Health

The application of the computer to generate information from farm data as a part of herd health programme was described by Russel and Rowlands (1983) and Noordhuizen *et al.* (1986). Fetrow *et al.* (1988) decribed a system

which utilized a commercial spreadsheet programme to monitor information available from the Dairy Herd Improvement (DHI) report and health data that were recorded separately by the farmers. Lissemore (1989) overviewed the application of computers in dairy herd health programme.

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 was described by Williams and Ward (1989). Udomprasert and Williamson (1990) developed an animal health management software programme 'DairyCHAMP' in the University of Minnesota to perform health management functions with the objectives of maintaining optional health and increasing the production efficiency of livestock.

Lees *et al.* (1993) designed a computer programme called 'CRITTER' in London specifically to track pedigree, location, health status and productivity of individual research animal of different species which could also be modified for use in area health surveillance programme while Lescourret *et al.* (1993) made data modeling for database design in health monitoring system for dairy herds of France. Spahr *et al.* (1993) described the application of computer for the management of health records of dairy cattle of Israel.

Enevoldsen *et al.* (1995) developed a diagnostic and prognostic tool for epidemiologic and economic analyses of dairy herd health management. 'Haemonchus', a computer programme was created by Bandyopadhyay and

Rajkhowa (1997) in India with an aim to provide the researcher/veterinarian and students, the facility of instant retrieval of the detailed information regarding Haemonchosis. Hayes *et al.* (1998) reported the benefits of on-farm use of a computerized management information system (DairyMAN) in health management of New Zealand dairy herds and a computerized programme for evaluating diarrhoea in piglets was developed by JongMyung *et al.* (1998).

**2.4.6 Record Keeping**

A computerized system with programmes in Fortran IV was developed by Erb *et al.* (1975) to organize and report detailed records of individuals in dairy herd in chronological order for teaching and research. Miller (1981), Speicher (1981), Udompraset and Williamson (1990), Devanand (1995) and Basheer (2001) described the application of computer in herd recording management.

The value of computerized record keeping system in small animal practice and equine veterinary practice was elaborated by Sard (1981). Thrusfield and Hinxman (1981) suggested that computerized system could be used for storing veterinary clinical case records in coded form. Voelker (1981) narrated the use of computerized record in Dairy Herd Improvement (DHI) programme.

Putler and Zilberman (1988) argued that an input that augmented worker ability would increase the productivity of physical labour and computerized book keeping and transaction programmes were worker-ability-augmenting-

inputs as they could increase the work out put per hour. Mueller (1989) reported that computerization of dairy records would allow the selection of individual cows for examination and the reviewing of lists of problem breeders during reproductive visits

Ko (1992) designed a herd health computer programme 'Vetcheck IV' that assisted in basic record keeping, formulation of action lists and herd analysis. Spahr *et al.* (1993) developed a database management system technology 'Dairybase', for the management of animal inventory, reproduction, genetic improvement, feeding, milk production and health records of dairy cattle in Israel. Tomaszewski (1993) assured that computerised record keeping systems provided an essential link that significantly increased the milk production and Spillane (1999) reported the use of computerized breeding herd records in a 1000 sow unit in Ireland.

Dairy farming now needs more records to be kept for quality management which is best brought about through the use of computerized records for each animal that integrate fertility, health and production (Esslemont and Kossaibati, 2000).

## 2.5 Data Management Systems in India

Livestock production is an integral part of agricultural system in India. Livestock sector is among the fastest growing sectors and yet apparently untouched by the information revolution. Recent experiences of development, workers and researchers indicated that there is an urgent need for developing

information systems to improve livestock production in India. Though we have been slow in adopting information technology for livestock sector, we have had some developments in the area (Devanand, 1995).

deGroot *et al.*, (1993) gave an overview of the experiences made in the Indo-Swiss Goat Development and Fodder Production Project (ISGP) on collection and processing of data from its field performance recording scheme, base farm, extension programme, and action research. The set up of the performance recording scheme and the developed computer application 'BAKRI' for the purpose were elaborated in detail.

The Indo-Swiss project Andra Pradesh, developed computer programme, namely the 'Herd Book System', 'Progeny Testing System' and 'Herd Fertility System' for processing and analyzing livestock information collected in the various institutions of the Department of Animal Husbandry (Mahel and Suryaprakasam, 1993).

Information systems development at the Central Sheep and Wool Research Institute (CSWRI), Avikanagar was initiated in 1984 and it has been managing a database of more than 30,000 sheep life-time records since 1987. Softwares developed at CSWRI were Clostridia, (a pro-type knowledge base system for illustrating knowledge base generation for application in animal disease diagnosis, using the example of clostridium infections), CSWRI-SRD (Sheep Research Database version 3 for managing life-time recording of an

animal) and CSWRI-DDIS (a disease data and information system for organized sheep and goat farms) (Maru, 1993).

The National Dairy Research Institute, Karnal, developed packages and data system to store and manage performance data of cattle and buffaloes (Sadana,1993). They were Buff pack (Buffalo Data Management Package) KsPack (Karanswiss Data management package), PTNDRI (Data management for Progeny Testing under field conditions), Male NDRI (Male calf and Bull selection package), Vet NDRI (Veterinary Dispensary Data Management) and Al (Calving Data Storage System).

The National Dairy Development Board (NDDB) developed computer system for their farm business operations (Trivedi and Patel, 1993). Under Operation Flood I, a computer based information system was developed on the mainframe system for its bull mother farms, which was named as Farm Recording System. With the advent of personnel computers, this system was modified and renamed as Dairy Herd Management System (DHMS). NDDB also developed a system for monitoring the performance of production enhancement activities in the field called as Field Recording System. Finding it difficult to manage collection and processing of a large amount of data, the programme of field recording was narrowed down to most purposeful programme of progeny testing of bulls and named as Dairy Herd Improvement Programme Actions (DIPA).

In association with National Informatics Center, the Animal Husbandry Department in Kerala developed a computer based information system for various programme and activities of the department (Nair, 1994). The information systems that were developed and implemented include DISNIC-MISAH (for processing the data on health status of various species of livestock), CABRIS (for monitoring and evaluating the Rearing of calves Scheme of Special Livestock Breeding Programme), PLANMIS (for monitoring the implementation of Plan schemes and APRMIS (for monitoring and analyzing the prices of livestock, livestock products and by-products and feed).

# *Materials and Methods*

# 3. MATERIALS AND METHODS

The study was carried out to compare the existing manual system of data recording with 'computerized data management system' developed to suit the present goat farm operations.

Kerala Agricultural University Sheep and Goat farm, representing a sample of organized farming of small ruminants, was selected for the present study. The study was conducted in the following order:

1. Evaluation of the existing system.
2. Identification of input requirement for developing computer program.
3. Development of computerized data management system.
4. Evaluation of the computerized data management system.
5. Comparison of the existing system with the computerized data management system.

## 3.1 Classification of the present registers

The existing registers of Kerala Agricultural University Sheep and Goat farm were classified into the following categories.

a. Stock registers *viz.*, livestock register, medicine stock register and miscellaneous articles stock register.

b. Feeding registers that included feed register.

c. Production registers such as registers of birth and milk recording and disposal.

d. Reproduction registers that included breeding register.

e. Disposal registers that included disposal and mortality register.

### 3.2 Evaluation of the existing system

The existing system of data recording was evaluated by using the following indices.

#### 3.2.1 Time requirement for day-to-day entry

It was measured by time required in seconds to enter a set of entries in each register irrespective of the day of occurrence of the event.

#### 3.2.2 Event-wise recording

The data pertaining to events like kidding, mortality, sales, breeding and milking in the goat farm were recorded. Evaluation of the existing system of data recording by event-wise recording was done by observing the time required in seconds for recording a set of entries in each event, irrespective of the day of occurrence of the event.

#### 3.2.3 Data retrievability

Time taken in seconds to retrieve the available data from the existing system was measured.

### 3.3 Identification of input requirements

Input requirements were determined based upon the data to be stored and the data to be obtained from the proposed computerized data management system. The data to be stored and obtained from the goat farm are:

a. Details of stock position

b. Details of feeding

c. Details of production

d. Details of reproduction

e. Details of disposal

f. Details of health

### 3.4 Development of Computerized Data Management System (CDMS)

Based on the information collected and anticipated reports required for an efficient goat farm management, a combination of Visual Basic 6.0 as front end tool and Microsoft Access 97 as back end tool were used to develop CDMS.

### 3.5 Evaluation of the computerized data management system

The developed computerized data management system was evaluated by the same parameters which were used to evaluate the existing system.

### 3.6 Comparison of the existing system with the computerized data management system

The data recorded were statistically analysed by employing student '*t*' test for comparing computerized management system and existing system (Snedecor and Cochran, 1994).

# *Results*

# 4. RESULTS

## 4.1 Evaluation of the existing system

### 4.1.1 Time requirement for day-to-day entry

Time required to enter a set of entries in the registers of livestock, birth, medicine, feed, miscellaneous articles stock, feed, milk recording and disposal, disposal and mortality and breeding in the existing system are presented in tables 4.1 and 4.2.

Average time required for entering a set of data in livestock, birth, medicine stock, miscellaneous articles stock, feed, milk recording and disposal, disposal and mortality and breeding registers in the existing system were found to be 21.36 ± 1.13, 34.58 ± 0.81, 30.86 ± 1.13, 32.06 ± 1.01, 32.94 ±1 .07, 18.39 ± 1.08, 31.47 ± 1.21 and 15.28 ± 1.03 seconds respectively.

### 4.1.2 Event-wise recording

Time required to record a set of entries in kidding, mortality, sale of animals, breeding and milking events are given in table 4.3.

Average time required for recording a set of entries in kidding, mortality, sale of animals, breeding and milking events were found to be 47.47 ± 1.52, 67.83 ± 1.69, 57.36 ± 1.48, 15.28 ± 1.03 and 18.39 ± 1.08 seconds respectively in the existing system.

**Table 4.1 Time required in seconds to enter a set of data in four registers in the existing manual system of KAU goat farm**

| Number of set of entries | Livestock register | Birth register | Medicine stock register | Miscellaneous article stock register |
|---|---|---|---|---|
| I | 21.33±1.03 | 34.83±0.75 | 30.83±1.17 | 32.33±1.03 |
| II | 21.50±1.05 | 34.17±0.75 | 31.17±0.75 | 32.17±0.98 |
| III | 21.83±1.47 | 34.50±1.05 | 30.67±1.51 | 32.17±1.17 |
| IV | 21.00±0.89 | 34.83±0.75 | 30.33±1.21 | 31.67±1.21 |
| V | 21.33±1.37 | 34.83±0.75 | 31.17±0.75 | 32.17±1.17 |
| VI | 21.17±1.17 | 34.33±0.82 | 31.00±1.41 | 31.83±0.75 |
| Average | 21.36±1.13 | 34.58±0.81 | 30.86±1.13 | 32.06±1.01 |

(Mean ± Standard deviation) (n=6)

**Table 4.2 Time required in seconds to enter a set of data in four registers in the existing manual system of KAU goat farm**

| Number of set of entries | Feed register | Milk recording and disposal register | Breeding | Disposal and mortality register |
|---|---|---|---|---|
| I | 33.33±1.03 | 18.50±1.38 | 15.33±1.03 | 31.00±1.41 |
| II | 33.00±1.41 | 18.33±1.21 | 15.17±1.17 | 31.17±1.33 |
| III | 32.83±1.17 | 18.17±1.17 | 15.17±1.17 | 31.50±1.05 |
| IV | 32.67±1.03 | 18.50±1.05 | 15.17±1.17 | 31.50±1.05 |
| V | 33.00±0.89 | 18.33±1.03 | 15.33±1.03 | 31.50±1.52 |
| VI | 32.83±1.17 | 18.50±1.05 | 15.50±1.05 | 32.17±0.98 |
| Average | 32.94±1.07 | 18.39±1.08 | 15.28±1.03 | 31.47±1.21 |

(Mean ± standard deviation) (n=6)

**Table 4.3 Time required in seconds to enter a set of data in five events in the existing manual system of KAU goat farm**

| Number of set of entries | Kidding | Mortality | Sales | Breeding | Milking |
|---|---|---|---|---|---|
| I | 46.83±1.47 | 66.50±1.64 | 56.67±1.63 | 15.33±1.03 | 18.50±1.38 |
| II | 48.00±1.41 | 67.00±2.10 | 57.00±1.79 | 15.17±1.17 | 18.33±1.21 |
| III | 42.33±1.63 | 67.17±2.32 | 57.33±1.86 | 15.17±1.17 | 18.17±1.17 |
| IV | 47.67±1.51 | 67.67±1.63 | 58.00±0.89 | 15.17±1.17 | 18.50±1.05 |
| V | 47.33±2.16 | 67.67±1.63 | 57.50±1.64 | 15.33±1.03 | 18.33±1.03 |
| VI | 47.67±1.21 | 68.00±1.41 | 57.67±1.03 | 15.50±1.05 | 18.50±1.05 |
| **Average** | 47.47±1.52 | 67.33±1.69 | 57.36±1.48 | 15.28±1.03 | 18.39±1.08 |

(Mean ± Standard deviation) (n=6)

### 4.1.3 Data retrievability

Time taken to get data on population status, feed ingredients, total quantity of feed fed to animals, number of animal bred, kidding, total milk production, milk disposal, mortality and sale, transfer, and culling in the existing system are presented in table 4.4.

## 4.2 Identification of input requirement for developing computerized data management system (CDMS)

Input requirement for developing CDMS were prepared initially in the form of flow charts to incorporate the details of information obtained and produce anticipated reports required to improve efficiency of CDMS. Flow charts for various menu are presented fig.4.1 to 4.9.

### 4.3.1 Login page

The format of login page is presented in fig. 4.10. It has 'username', 'password' and command buttons like 'OK' and 'cancel'.

### 4.3.2 Main menu

Fig. 4.11 shows the details of menu *viz.*, status, feeding, production, reproduction, health, disposal, view, reports and exit.

### 4.3.3 Status

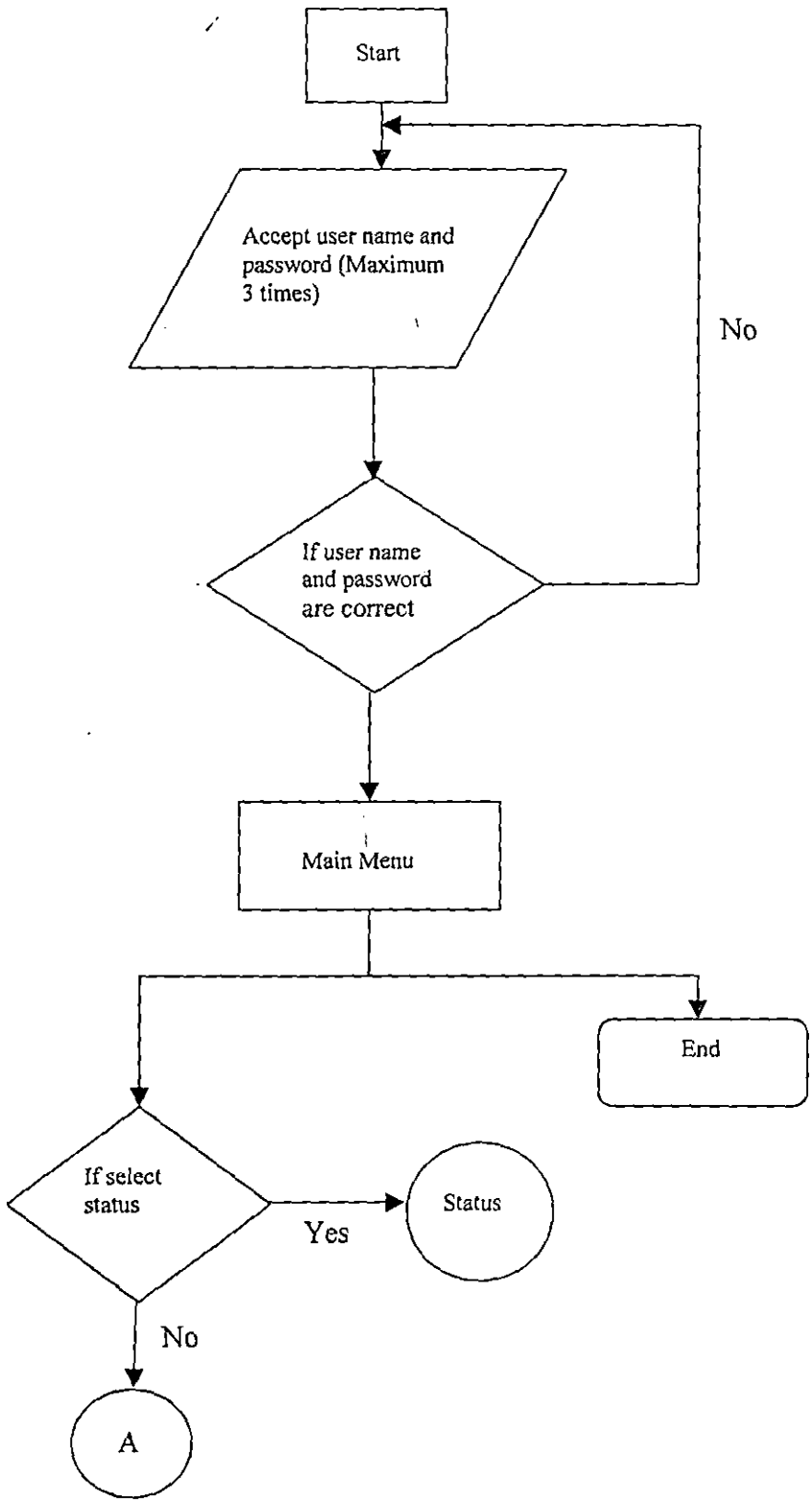
The status menu consisted of seven options *viz.* kids, young stock, adult stock, total stock, daily stock, medicine and miscellaneous articles.

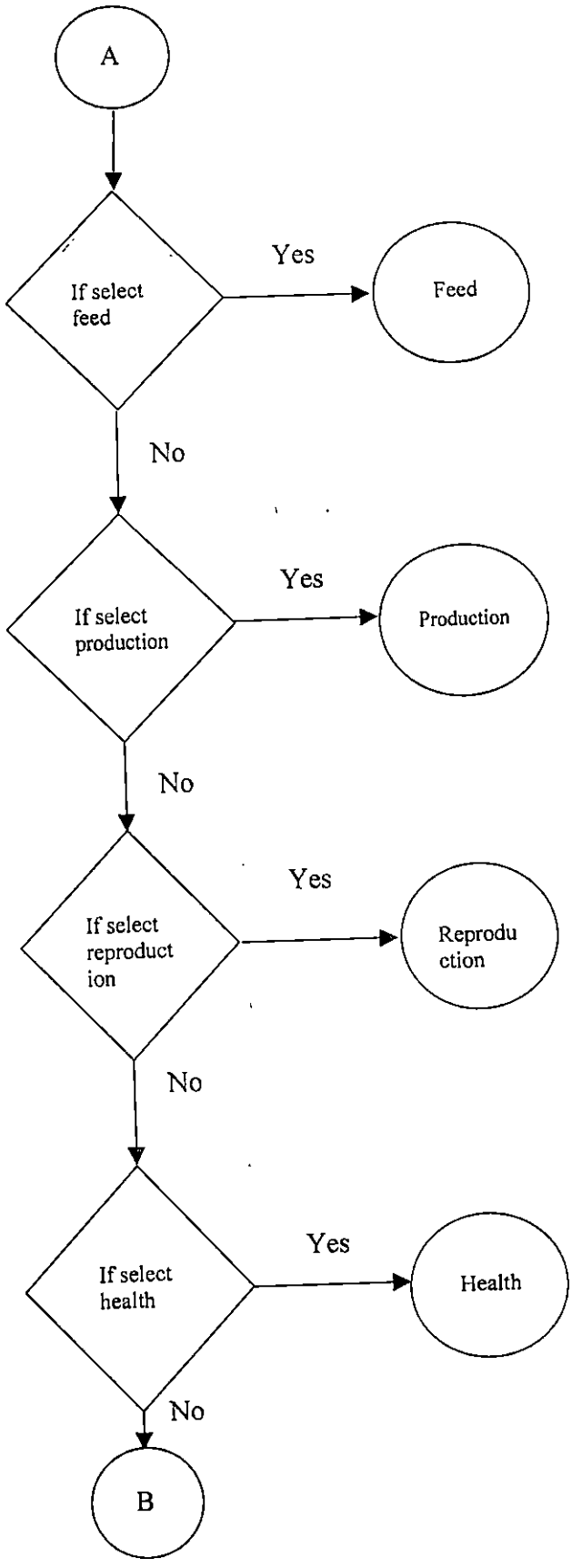
**Table 4.4 Data retrievability in seconds in the existing manual system of KAU goat farm**

| Sl. No. | Data to be available at a particular period | Data retrievability |
|---|---|---|
| 1 | Populations status | 185.83 ±7.36 |
| 2 | Feed ingredients | 35.33 ±4.97 |
| 3 | Total quantity of feed fed to the animal | 39.33 ±5.01 |
| 4 | Number of animals bred | 98.33 ±6.83 |
| 5 | Kidding | 193.33 ±7.53 |
| 6 | Milk production | 18.67 ±1.51 |
| 7 | Milk disposal | 18.67 ±2.50 |
| 8 | Mortality | 310.83 ±7.36 |
| 9 | Sale, transfer and culling of animal | 315.00 ±11.83 |
| 10 | Medicine and miscellaneous articles stock | 135.00 ±10.72 |

(Mean ± standard deviation) (n=6)

**Fig. 4. 1 Log in Menu and Main Menu**




A
If select feed
Yes
Feed
No
If select production
Yes
Production
No
If select reproduct ion
Yes
Reprodu ction
No
If select health
Yes
Health
No
B

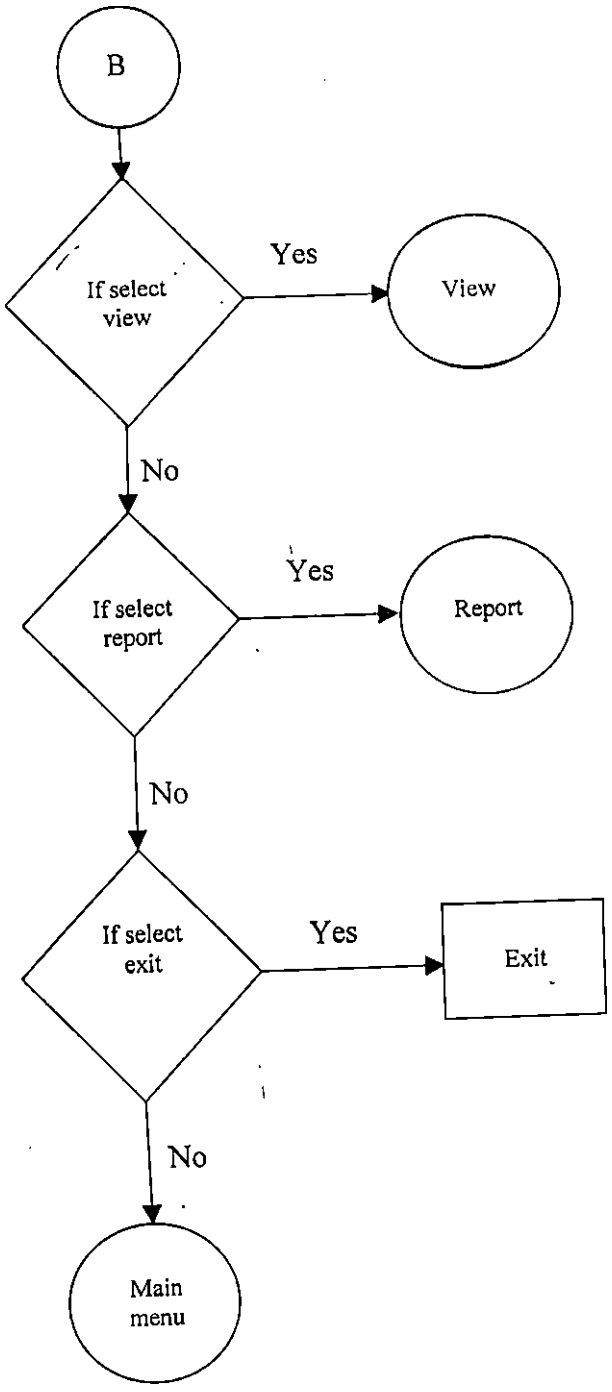
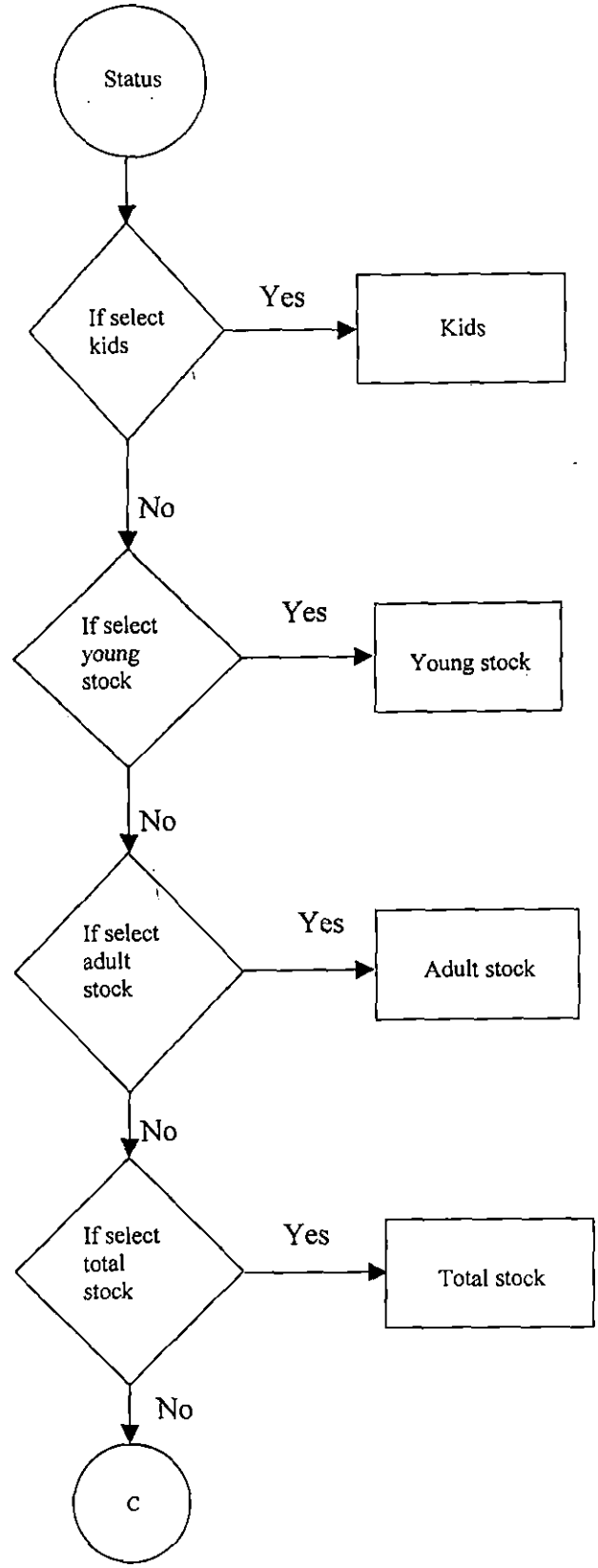

B
If select view
Yes
View
No
If select report
Yes
Report
No
If select exit
Yes
Exit
No
Main menu

**Fig. 4. 2 Status Menu**



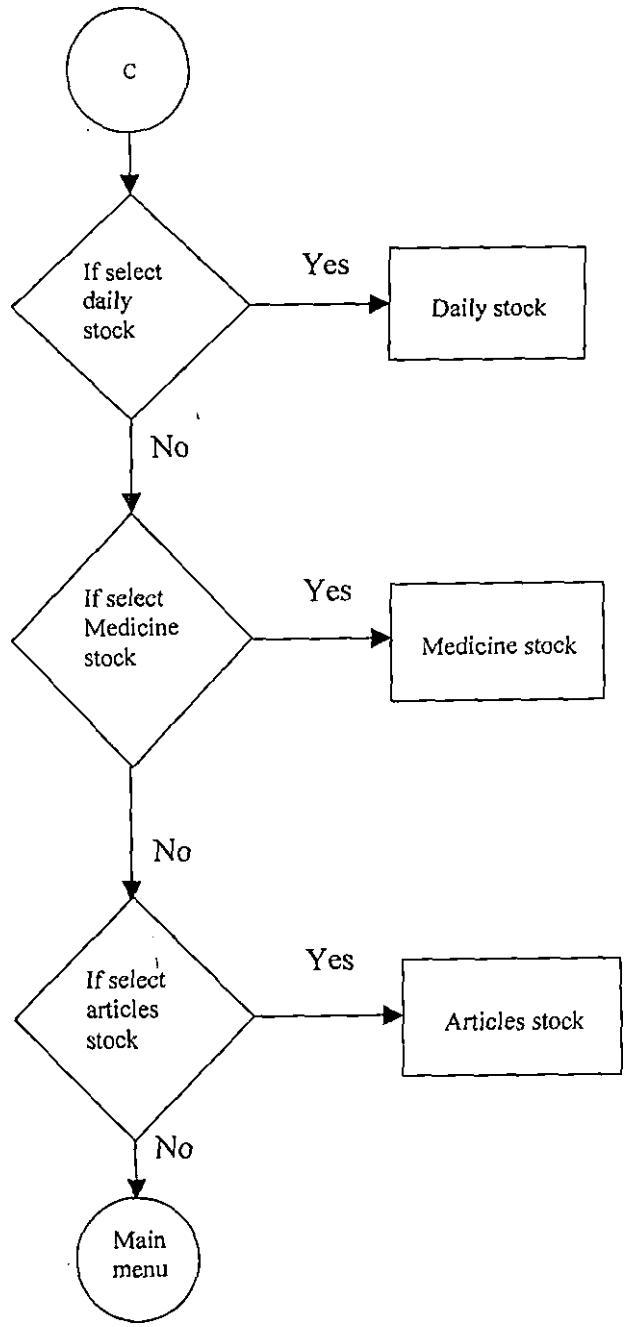

c
If select daily stock
Yes
Daily stock
No
If select Medicine stock
Yes
Medicine stock
No
If select articles stock
Yes
Articles stock
No
Main menu

**Fig. 4. 3 Feed Menu**

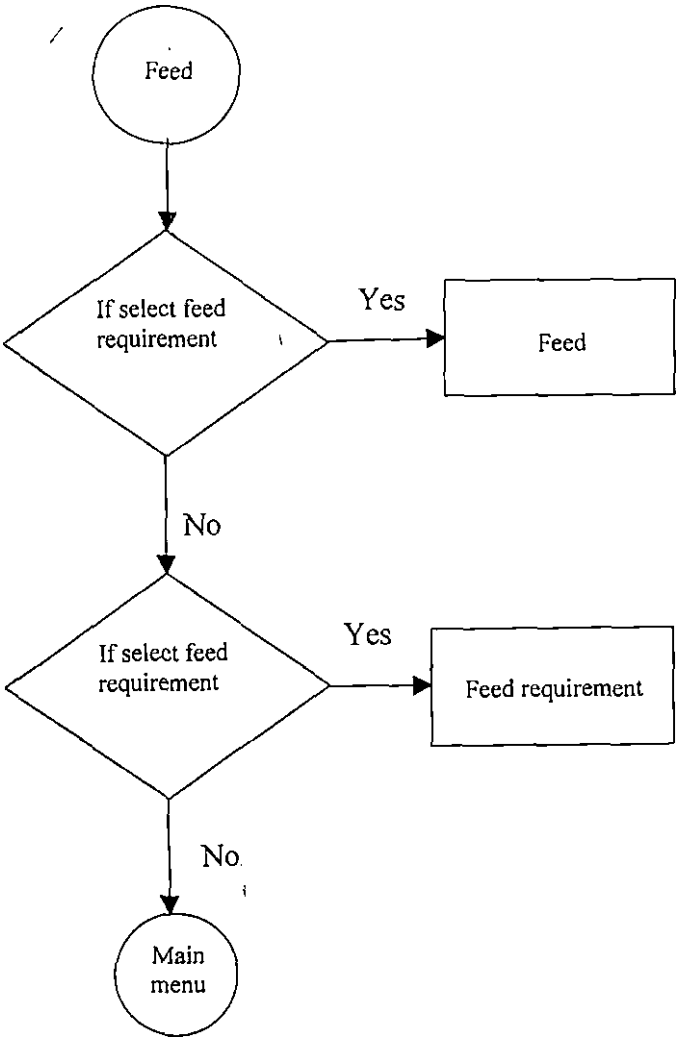


**Fig. 4. 4 Production Menu**

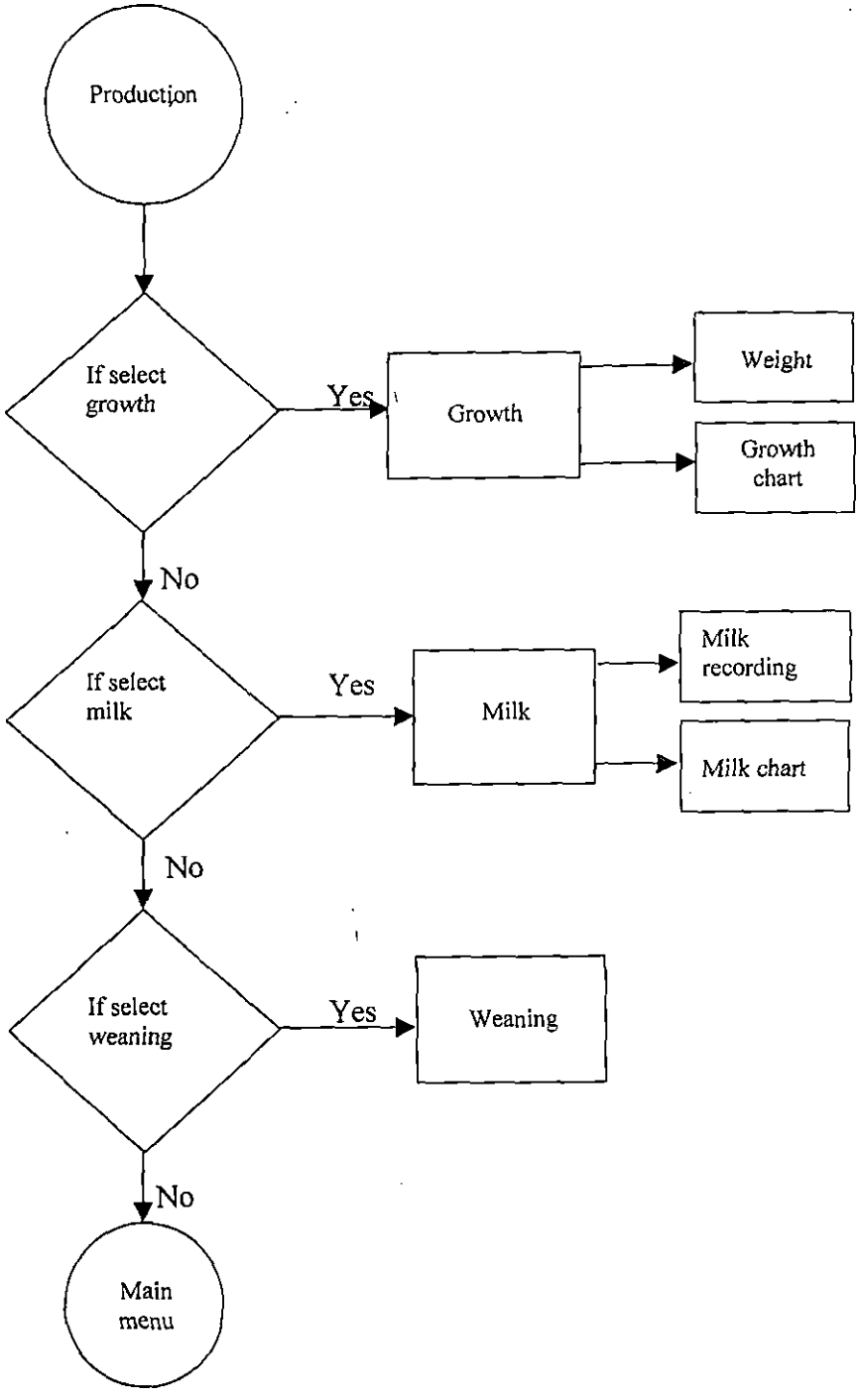


**Fig. 4. 5 Reproduction Menu**

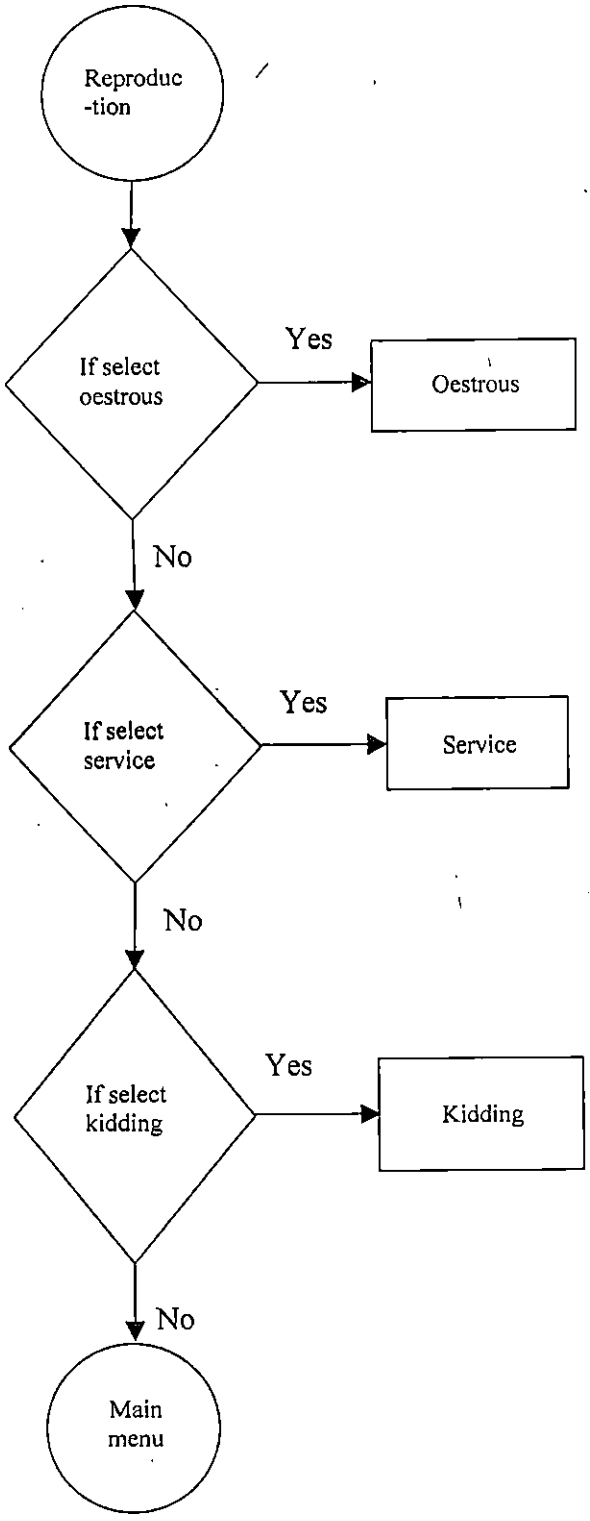
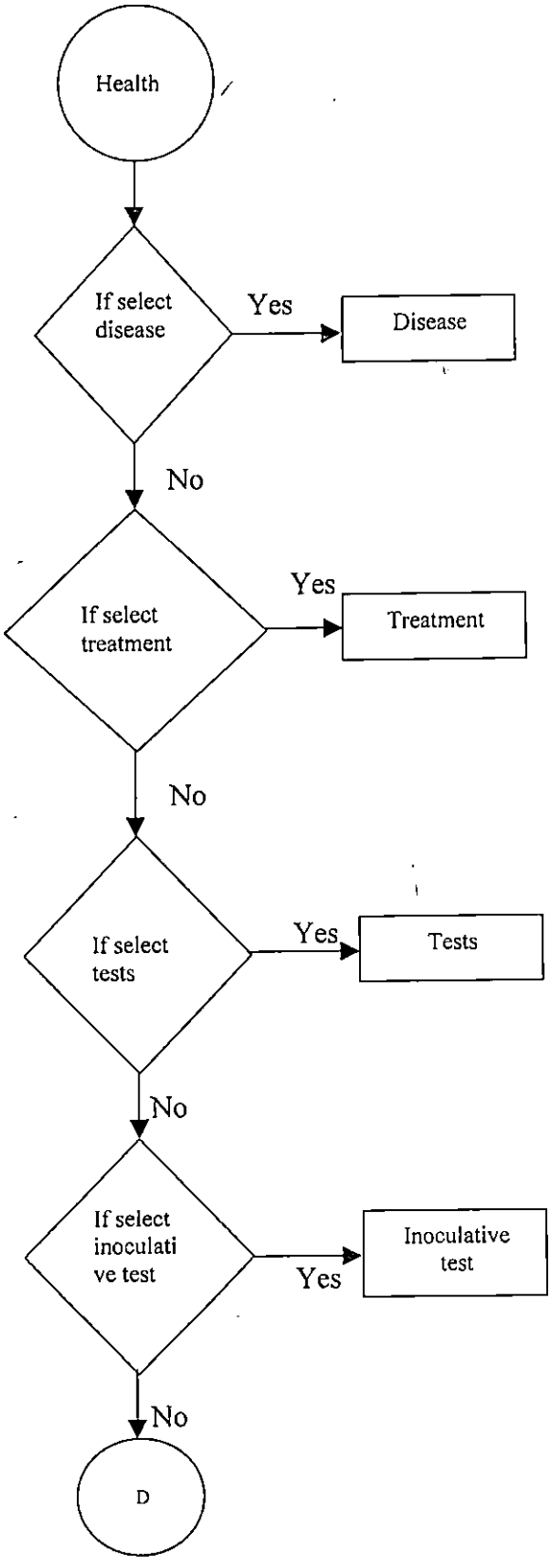


**Fig. 4. 6 Health Menu**



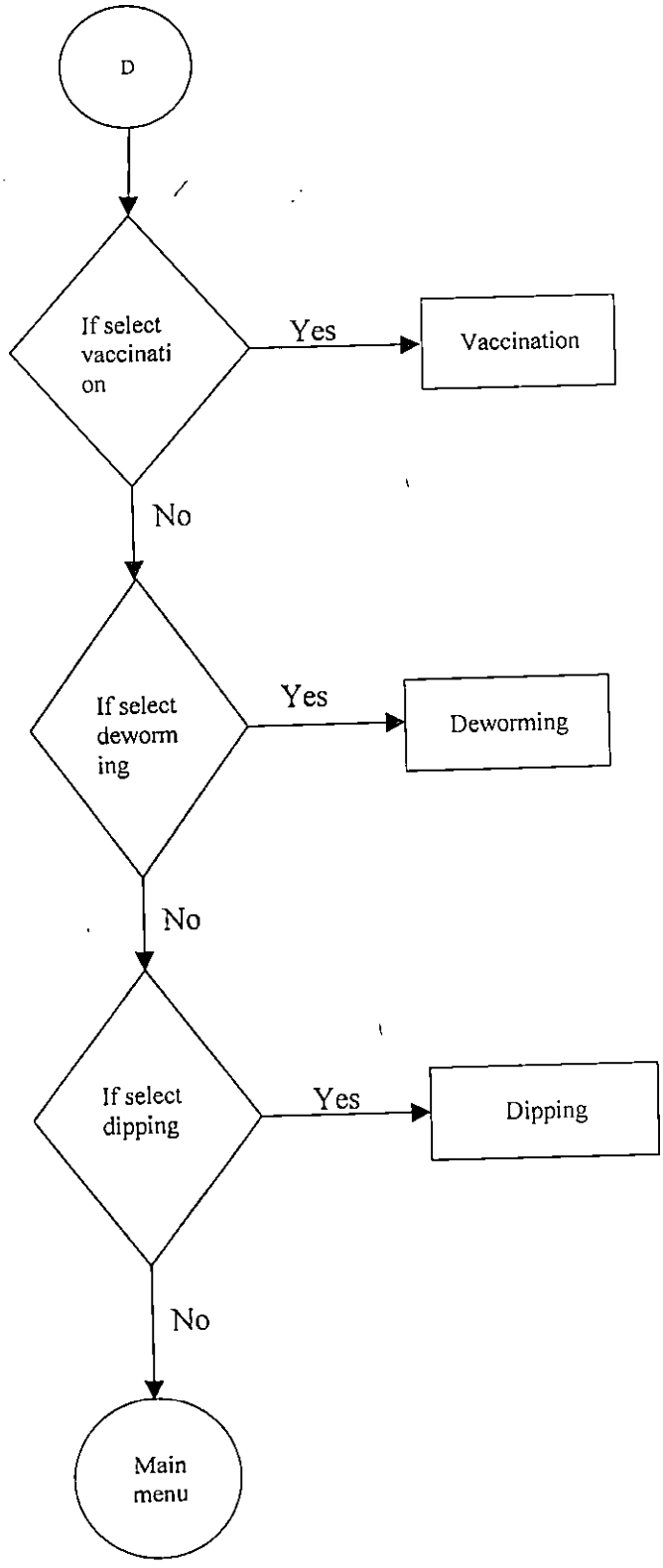
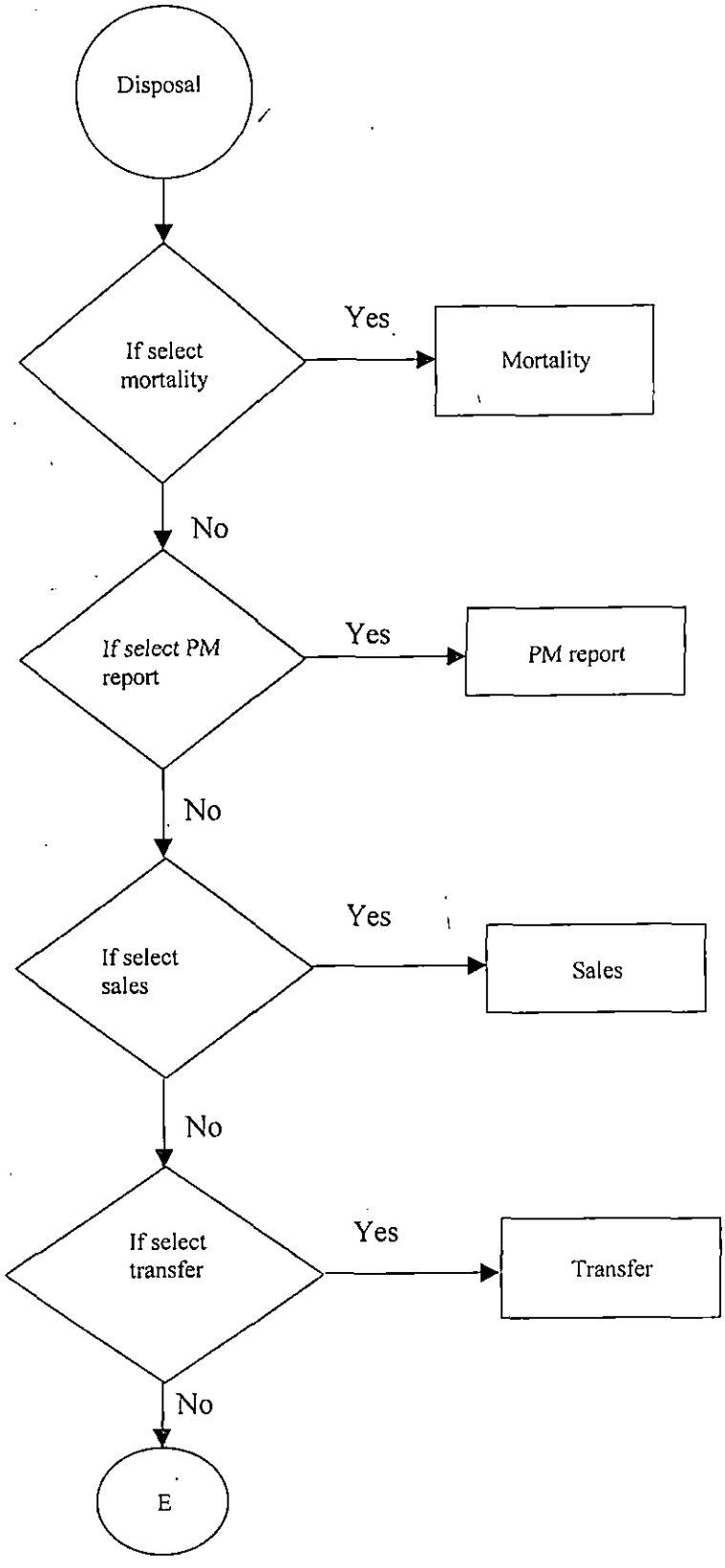

D
If select vaccinati on
Yes
Vaccination
No
If select deworm ing
Yes
Deworming
No
If select dipping
Yes
Dipping
No
Main menu

**Fig. 4. 7 Disposal sub menu**



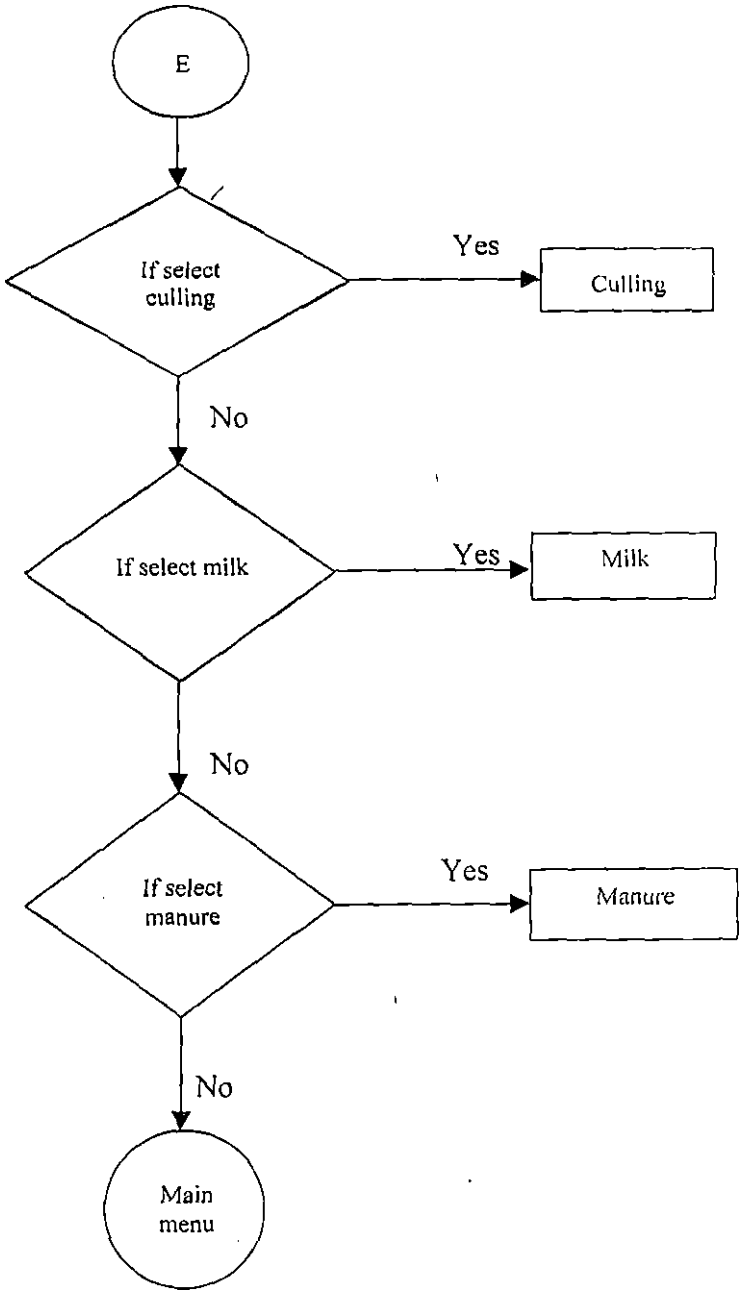
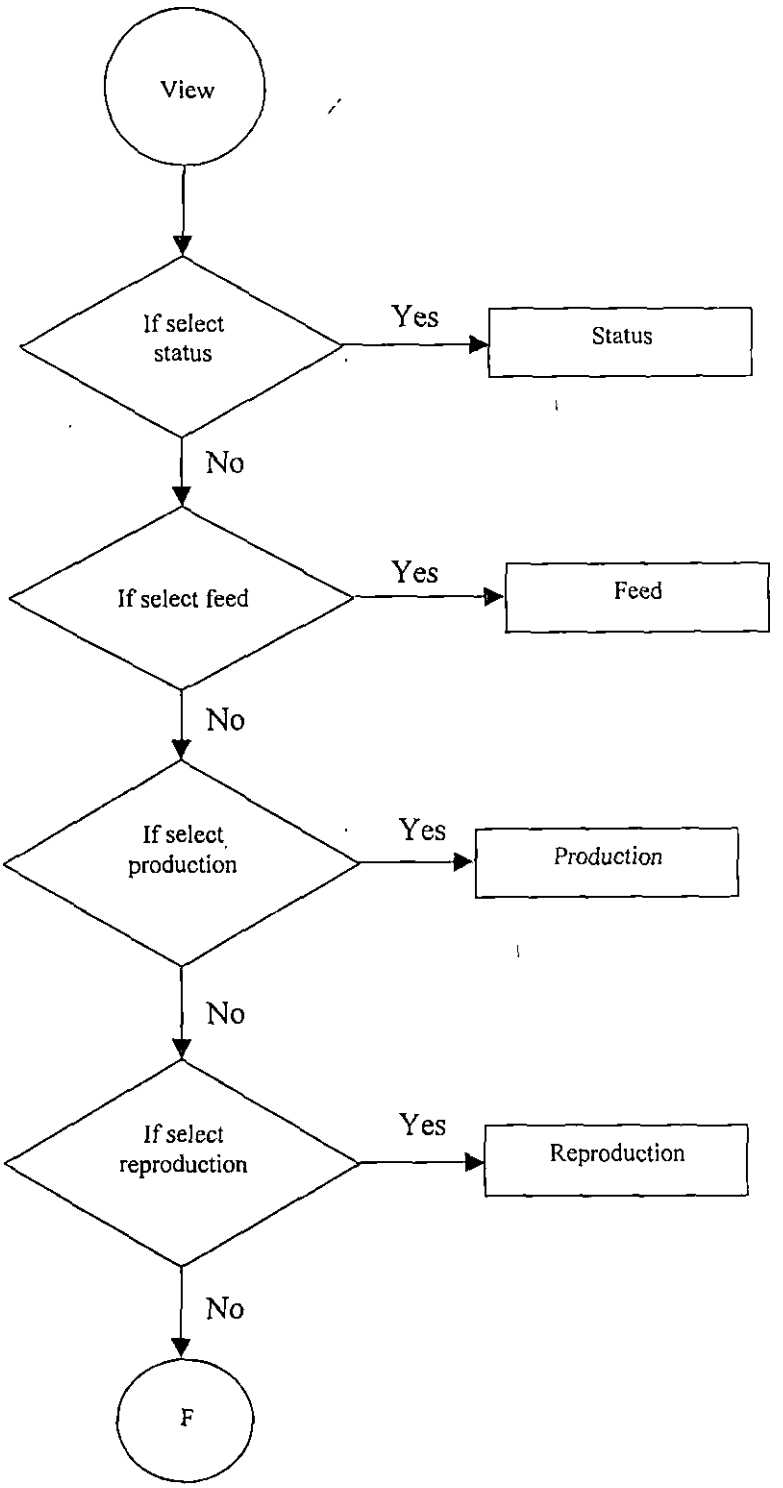

E
If select culling
Yes
Culling
No
If select milk
Yes
Milk
No
If select manure
Yes
Manure
No
Main menu

**Fig. 4. 8 View Menu**



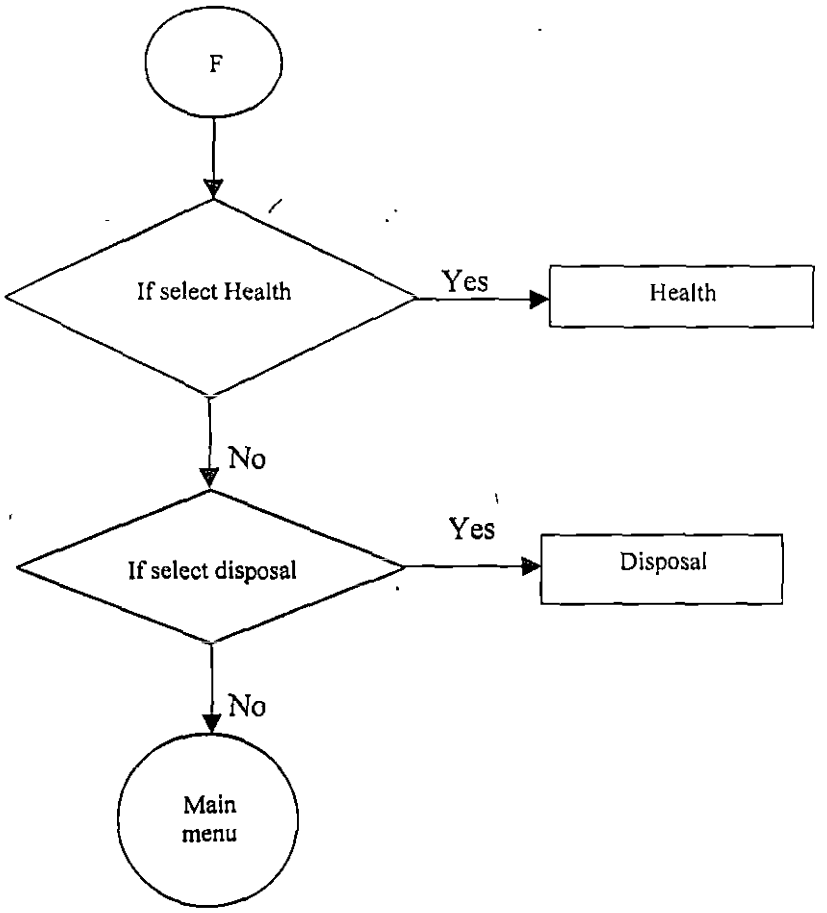
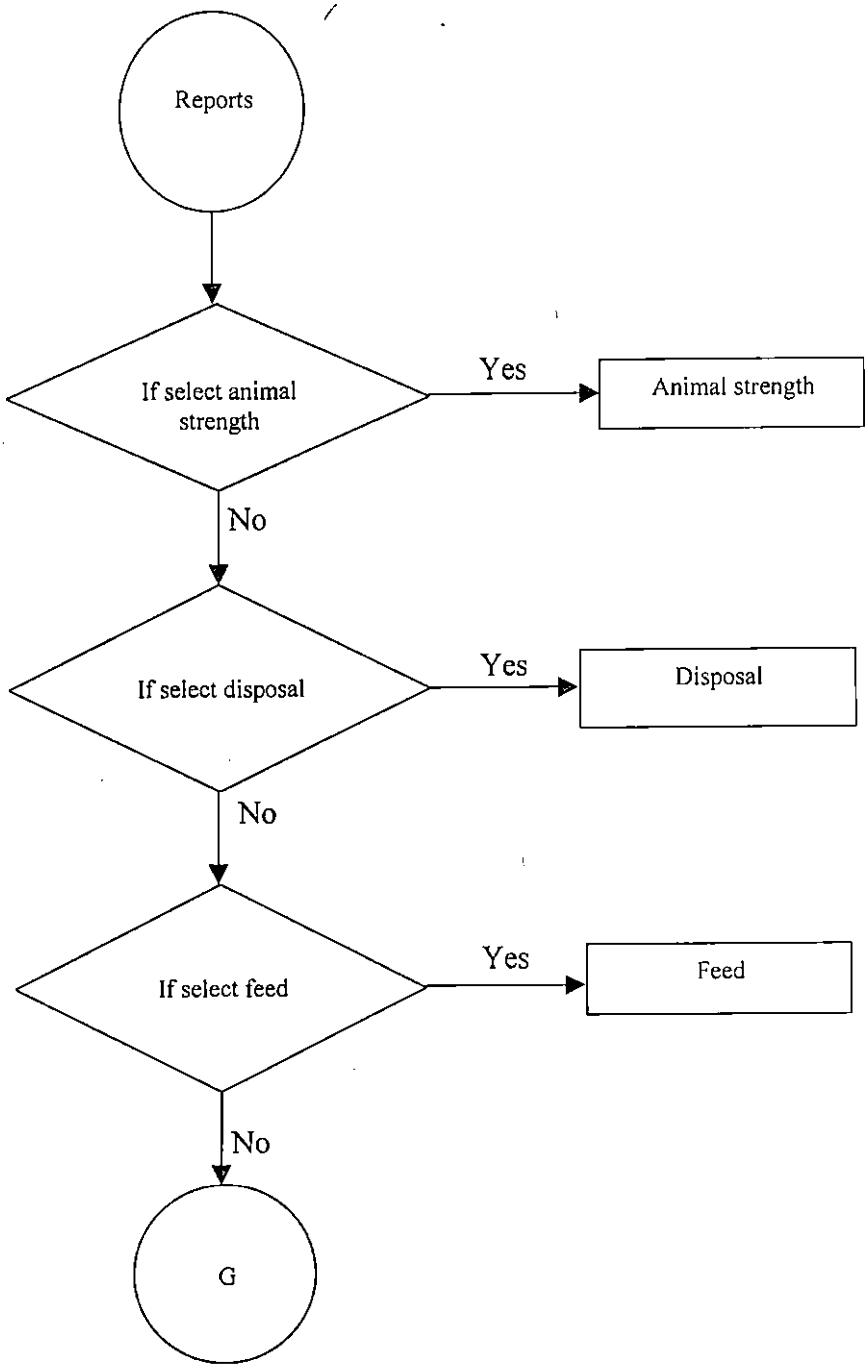

F
If select Health
Yes
Health
No
If select disposal
Yes
Disposal
No
Main menu

**Fig. 4. 9 Report Menu**



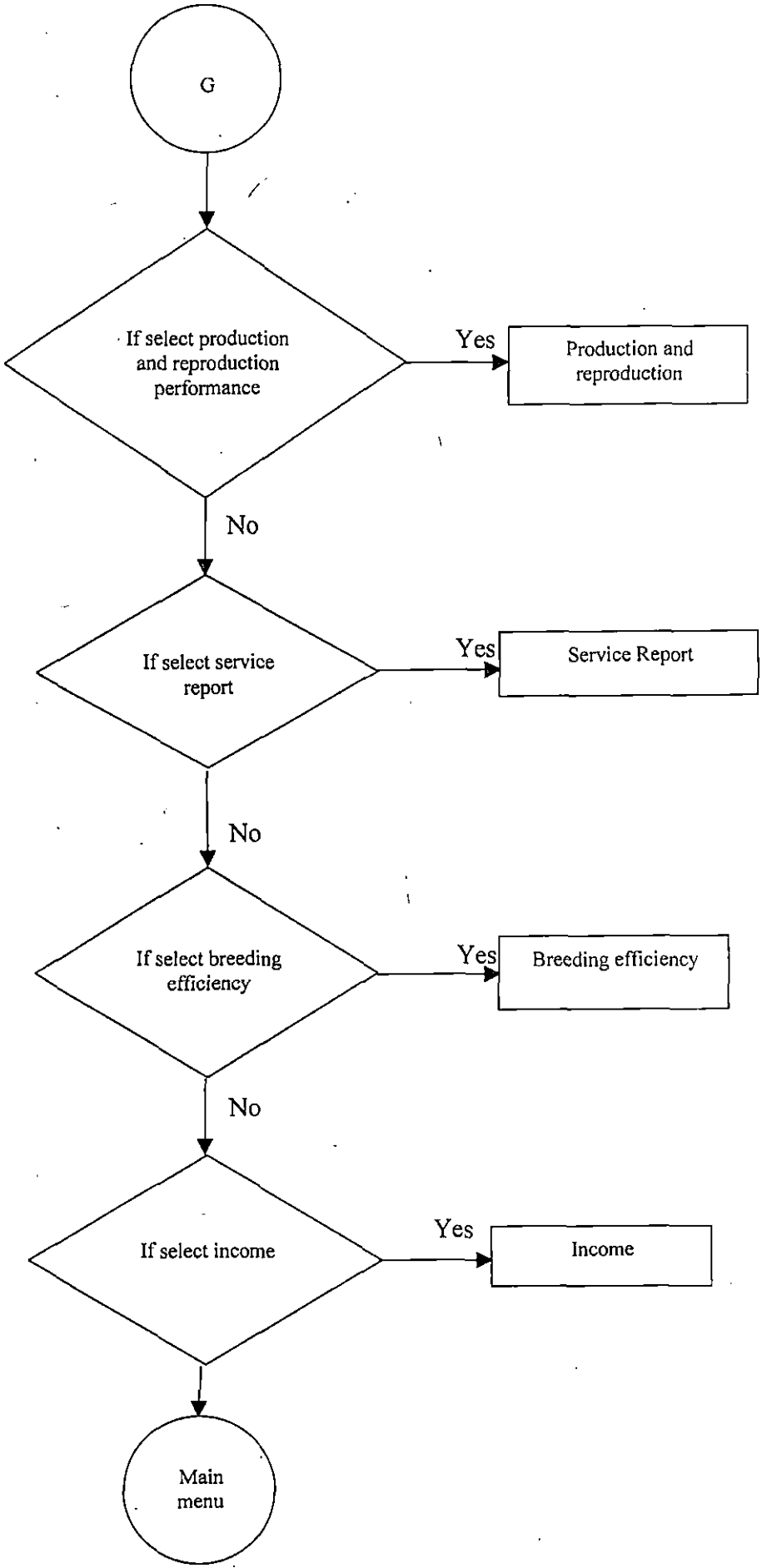

G
If select production and reproduction performance
Yes
Production and reproduction
No
If select service report
Yes
Service Report
No
If select breeding efficiency
Yes
Breeding efficiency
No
If select income
Yes
Income
Main menu

**Fig. 4.10 Login submenu**

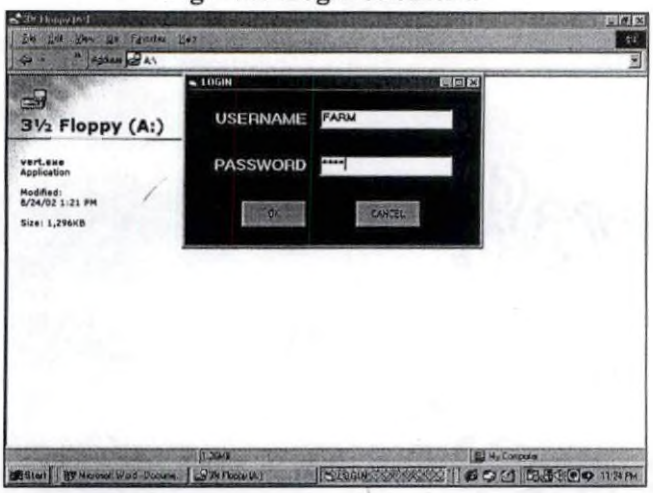
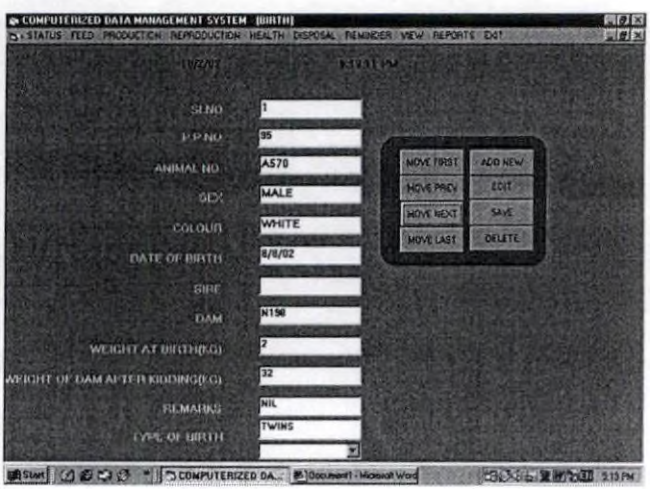



**Fig. 4.11 Main Menu**


**Fig.4.12 Kids submenu**



#### 4.3.3.1 Kids

The data input format for entering the details of kids is illustrated in fig. 4.12. The data input included animal number, date of birth, sex, colour and identification markings, sire number, dam number, weight at birth, weight of dam at kidding and remarks. It provided the following options of 'move first', 'previous', 'next' and 'last' records, to 'add new' records, to 'edit', 'save' and 'delete' the records.

#### 4.3.3.2 Young stock

The details regarding young stock were entered in format as shown in fig. 4.13. The data entered were, animal number, date of birth, sex, colour and identification markings, sire number, dam number, details of purchase including date of purchase, value of animal and source of purchase, date of transfer to adult stock and remarks. The options to 'move first', 'previous', 'next', 'last', 'add new', 'edit', 'save' and 'delete' the record were also given in young stock submenu.

#### 4.3.3.3 Adult stock

The format showing the adult stock record is presented in fig. 4.14. This submenu included animal number, date of birth, sex, colour and identification markings, sire number, dam number, details of purchasing date, value and source, date of transfer to adult stock and remarks.

It provided the following options of 'move first', 'previous', 'next' and 'last' records, to 'add new' records, to 'edit', 'save' and 'delete' the records.

Fig.4.13 Young stock submenu

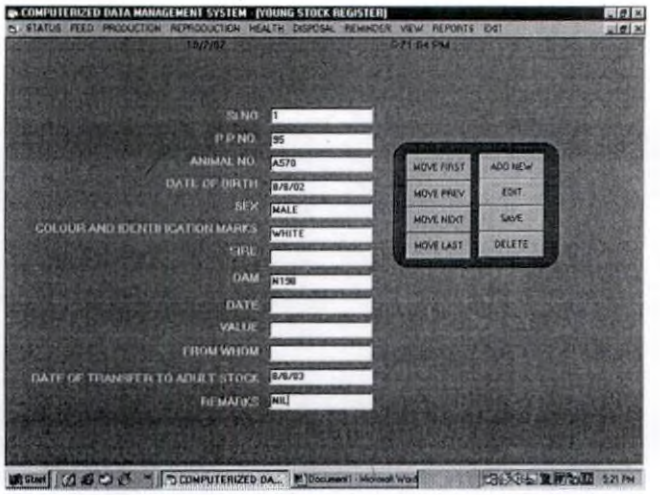



Fig.4.14 Adult stock submenu

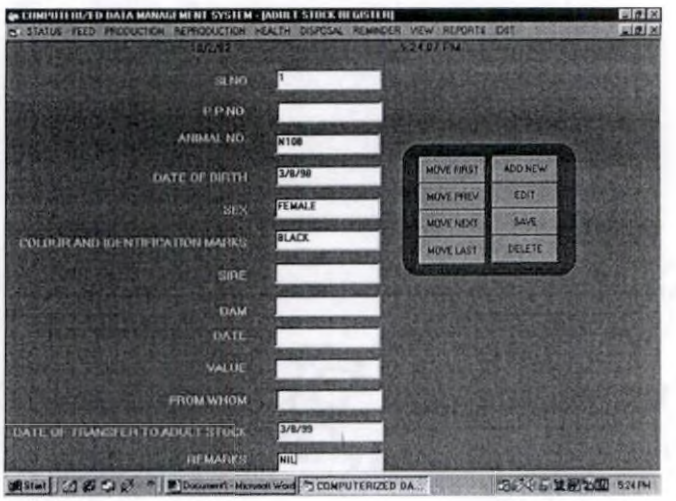
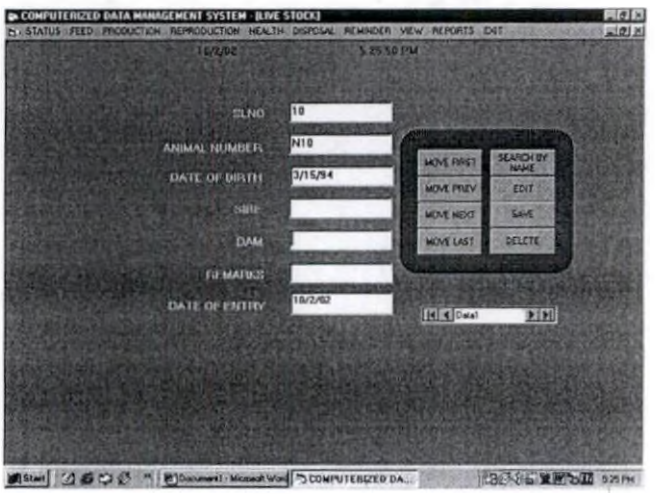



Fig.4.15 Total stock submenu



#### 4.3.3.4 Total stock

Fig. 4.15 illustrates the total stock record.

The details of animal number, date of birth, sire number, dam number and remarks were given in this submenu.

The options to 'move first', 'previous', 'next', 'last', 'add new', 'edit', 'save' and 'delete' the record were also given in young stock submenu.

#### 4.3.3.5 Daily stock

Fig. 4.16 shows the format of getting daily stock details including 0 to 3 months, 3 to 6 months, 6 to 12 months kids above one year animal, and total number of animals.

#### 4.3.3.6 Medicine and miscellaneous articles

As could be seen from fig. 4.17 and 4.18 there were provisions for entering the details of medicine and miscellaneous articles in the farm respectively. The data entered were date of entry, name of medicine (name of article in case of miscellaneous article record) and type of transaction *viz.* received and issued. The 'received' option consisted of source of medicine/article date of receival, bill number, value of medicine/article quantity purchased, bill amount and opening and closing balance of the stock. The particulars of issue such as quantity issued and opening and closing balance were entered in the 'issued' option.

It provided the following options of 'move first', 'previous', 'next' and 'last' records, to 'add new' records, to 'edit', 'save' and 'delete' the records.

Fig.4.16 Daily stock submenu

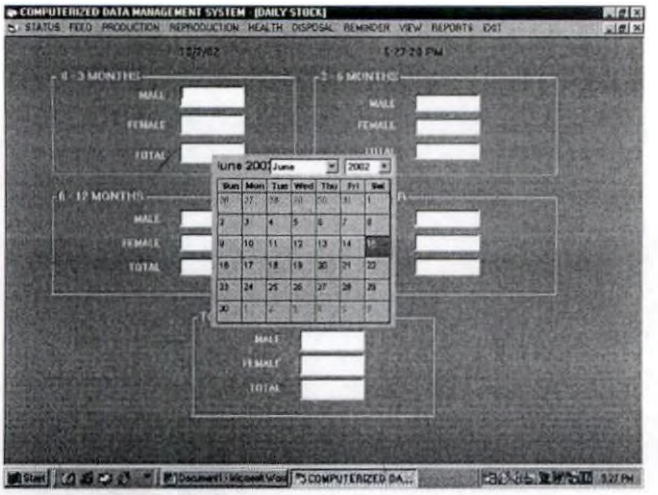



Fig.4.17 Medicine stock submenu

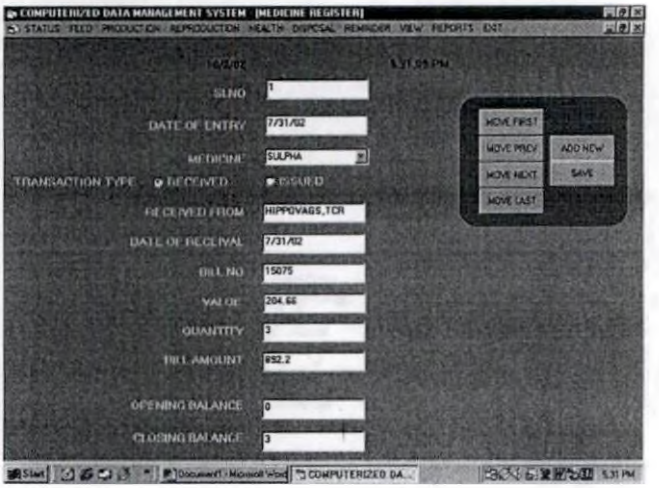
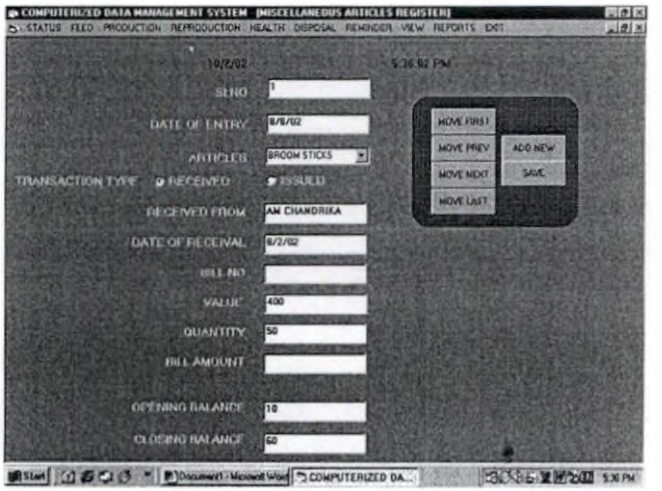



Fig. 4.18 Miscellaneous articles submenu



### 4.3.4 Feed

Two submenus constituted feed menu *viz.*, feed and feed requirement.

#### 4.3.4.1 Feed

Fig. 4.19 explains the structure of feed submenu. This menu provided information about date of entry, name of feed ingredients purchased, type of transaction like received and issued. The details of transaction given in the medicine/miscellaneous articles records were also used in the submenu.

#### 4.3.4.2 Feed requirement

This submenu possessed two options *viz.* individual and group feeding.

The format displaying feed requirement records is as shown in fig. 4.20. The individual feeding submenu exhibits animal number, date of birth, date of feeding, age and status of animal. The group feeding submenu gave information about date of feeding, total number of animals and status of animals.

### 4.3.5 Production

This menu included three submenus *viz.*, growth, milk and weaning.

#### 4.3.5.1 Growth

This submenu made up of two sub menus such as weighing and growth chart.

Fig.4.19 Feed submenu

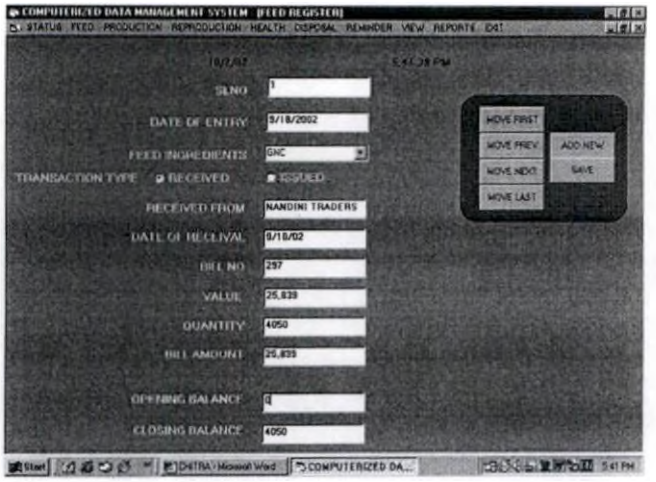



Fig.4.20 Feed requirement submenu

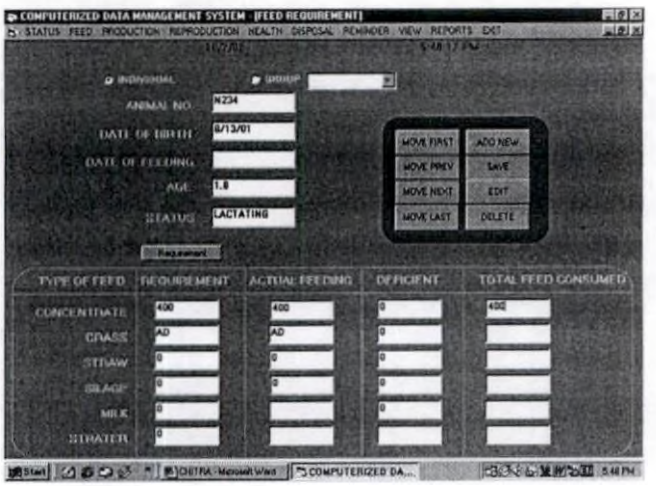
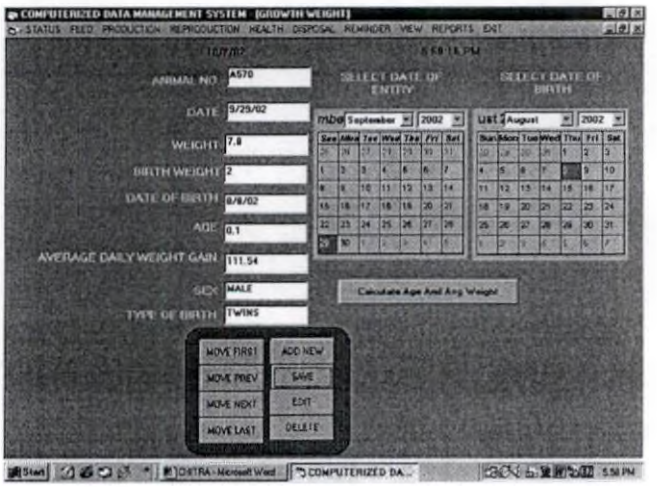



Fig.4.21 Weighing submenu



#### 4.3.5.1.1 Weight

Fig. 4.21 illustrates the format of weighing submenu details. This submenu consisted of animal number, date of weighing, weight in kg., birth weight, date of birth, age, sex, type of birth and average daily weight gain.

The options to 'move first', 'previous', 'next', 'last', 'add new', 'edit', 'save' and 'delete' the record were also given in young stock submenu.

#### 4.3.5.1.2 Growth chart

The format of growth chart is given in fig. 4.22. The X-axis of the chart represented date of weighing and the Y-axis of the chart represented weight in kg.

### 4.3.5.2 Milk

This sub menu contained two submenus *viz.*, milk recording and milk chart.

#### 4.3.5.2.1 Milk recording

The format for entering the milk recording details of an animal is presented in fig. 4.23. The data entered were animal number, date of recording, milk yield in morning and evening in ml, total milk yield in a particular day, date of kidding and dry off date.

The different options given in this submenu for handling the records were 'move first', 'move previous', 'move next', 'move last', 'add new', 'save', 'edit' and 'delete'.

Fig.4.22 Growth chart submenu

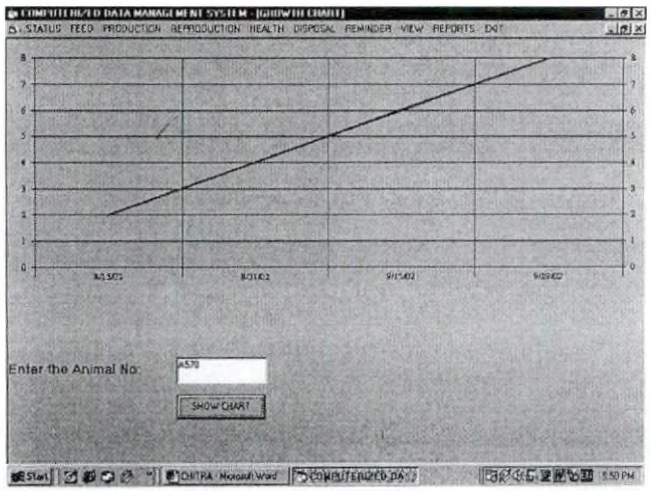



Fig. 4.23 Milk recording submenu

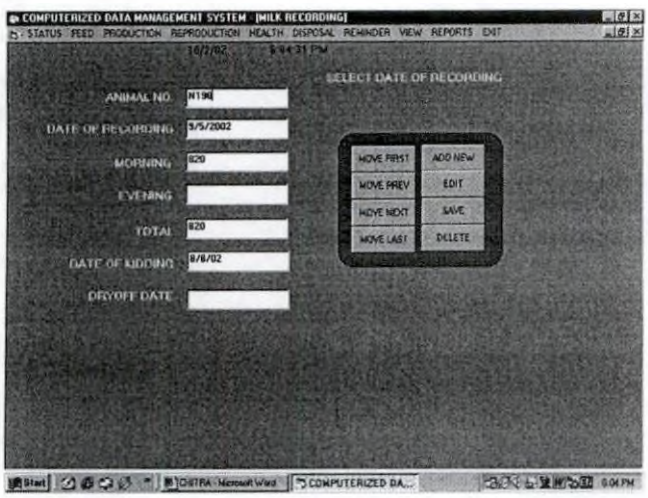
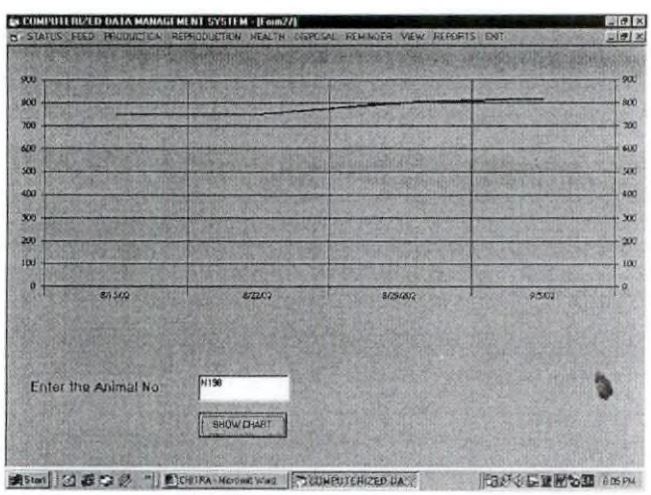



Fig.4.24 Milk chart submenu



#### 4.3.5.2.2 Milk chart

Fig. 4.24 shows the format of milk chart. The X-axis and Y-axis represent date of milk recording and quantity of milk in ml respectively.

### 4.3.5.3 Weaning

The data pertaining to the animal, number, date of weaning, weight at weaning, birth weight, date of birth, age, sex, type of birth and average daily weight gain were the inputs in the format as shown in fig.4.25.

This submenu provided the options of 'move first', 'previous', 'next' and 'last records', 'add new' records, 'edit' and 'delete' the records and 'calculate age and average daily weight gain'.

## 4.3.6 Reproduction

This menu was provided with three submenus viz. oestrous, service and kidding.

There were provisions to 'move first', 'previous', 'next' and 'last records', 'add new' records and 'save', 'edit' and 'delete' the records, in these three sub menus.

### 4.3.6.1 Oestrous details

As shown in fig. 4.26, this submenu provided the details relating to oestrous such as animal number, date of heat, date of examination, signs of heat, probable date of next heat, remarks and expected date of service.

Fig.4.25 Weaning submenu

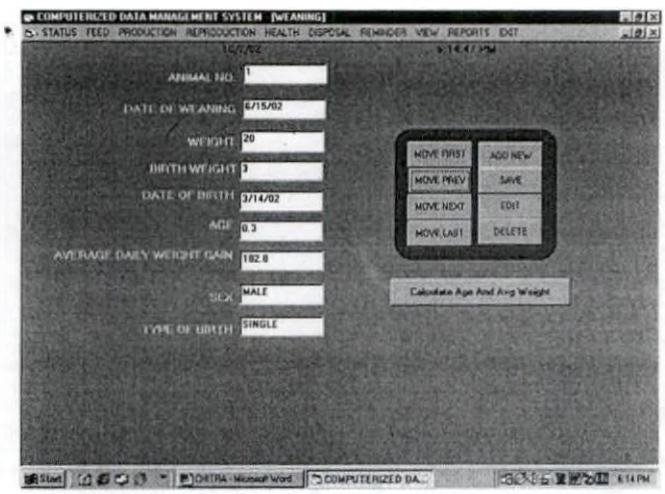



Fig.4.26 Oestrous submenu

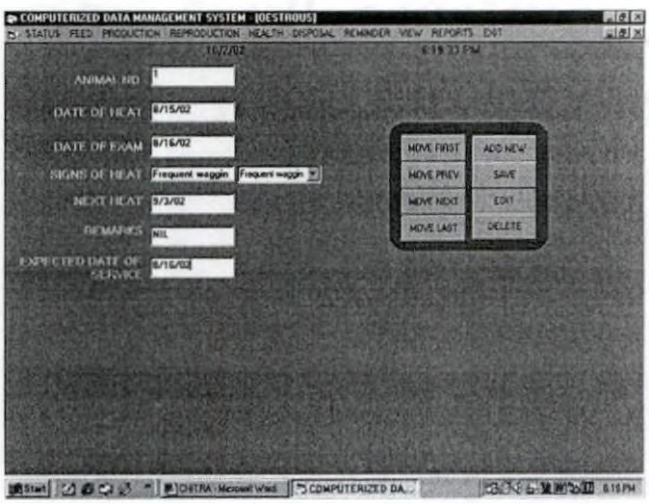
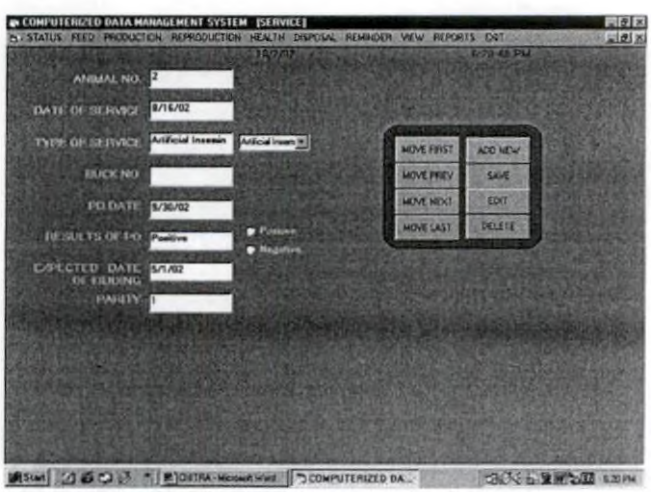



Fig.4.27 Service submenu



#### 4.3.6.2 Service

This submenu provided service details of animals. Fig.4.27 explains that there were provisions for recording animal number, date of service, type of service, bull number, date of pregnancy diagnosis done, results of pregnancy diagnosis, expected date of kidding and parity number of the animal.

#### 4.3.6.3 Kidding

Kidding submenu allowed to report the kidding event of the farm, which provided various details such as animal number, parity number of the animal, date of kidding, kidding interval, type of kids, date of dry off, sex, doe weight at kidding, litter weight and remarks (fig 4.28).

### 4.3.7 Health

Seven submenus constituted healthy menu *viz*., illness, treatment, tests, inoculative tests, vaccination, deworming and dipping. All these submenus were provided with the options of 'move first', 'next', 'last' and 'previous' record, and 'save', 'edit' and 'delete' the records.

#### 4.3.7.1 Diseases

Diseases submenu was included to record animal number, symptoms shown by animal date of beginning and ending of disease condition, duration of treatment, diagnosis made, treatment given and result. The details are shown in fig. 4.29.

Fig.4.28 Kidding submenu

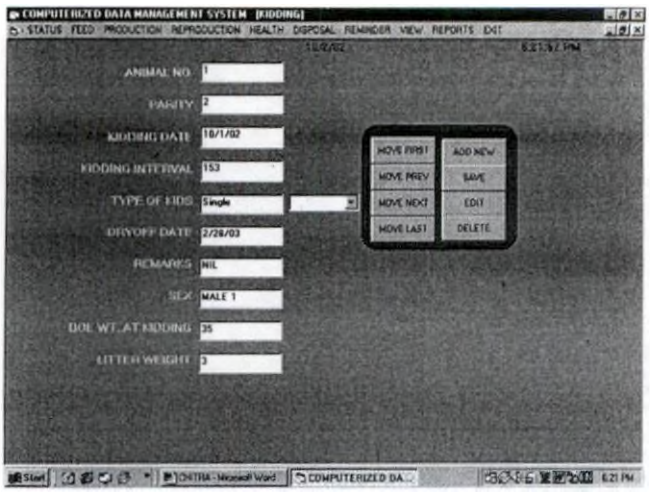



Fig.4.29 Diseases submenu

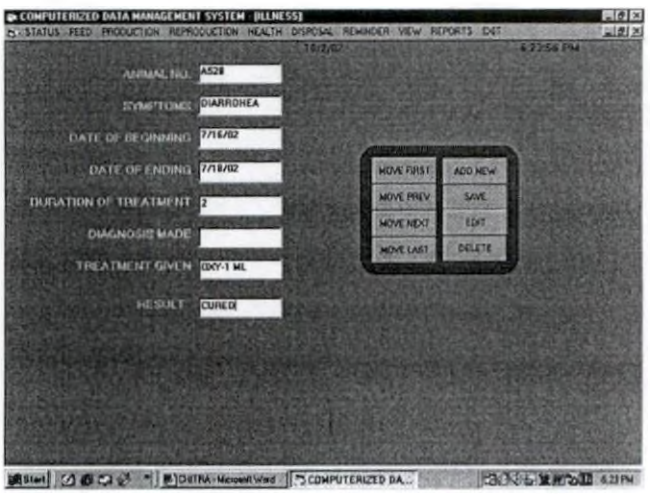
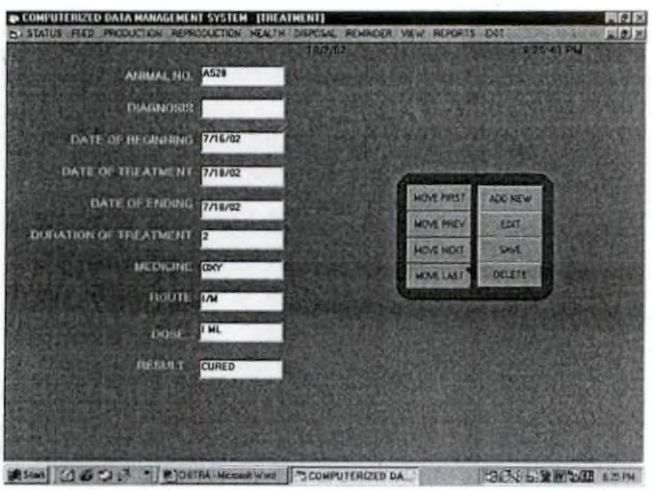



Fig.4.30 Treatment submenu



#### 4.3.7.2 Treatment

The data input format for entering the details of treatment given, is as shown in fig.4.30. This included animal number, diagnosis made, date of beginning, subsequent date, date of ending, and duration of the treatment, medicine administered, route of administration, dose of the medicine and results.

#### 4.3.7.3 Tests

Fig.4.31 illustrates the manner in which the details of tests are to be entered. The data input consisted of animal number, diagnosis, date of testing, symptoms shown, specimen collected, name of test done, and result of the test.

#### 4.3.7.4 Inoculative tests

The details of inoculative tests to be entered in the format is shown in fig. 4.32. This submenu included animal number, date on which the disease was tested, medicines administered, route of administration, dose of the medicine, result of the test and due date for the next inoculative tests.

#### 4.3.7.5 Vaccination

The format for entering the vaccination details is given in fig.4.33 and it included the animal number, date of vaccination, vaccine against, name of the vaccine, route and dose of the vaccine, results and due date for next vaccination.

Fig. 4.31 Test submenu

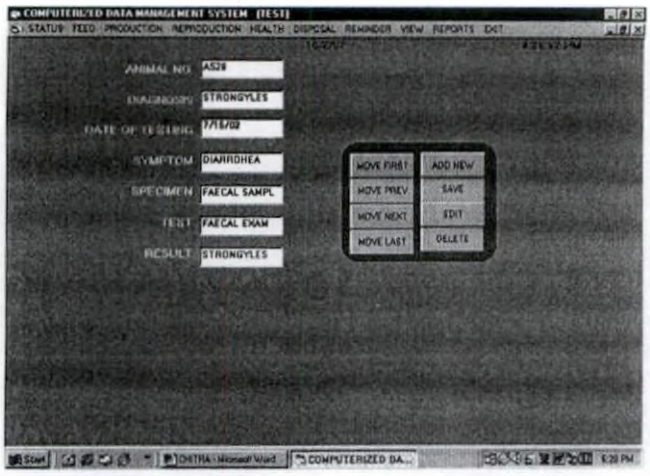



Fig. 4.32 Inoculative tests submenu

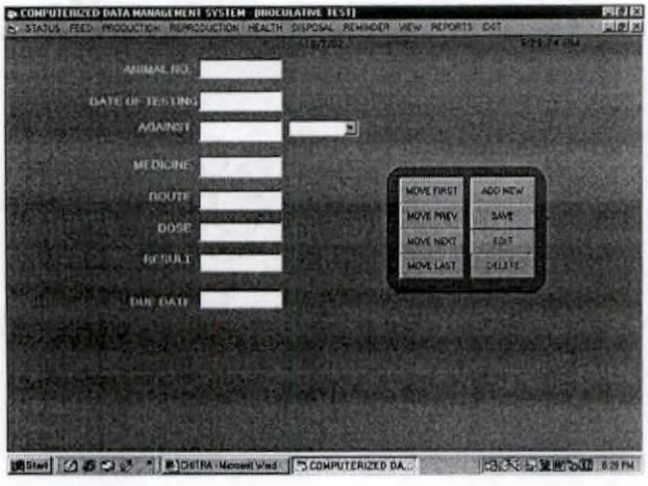
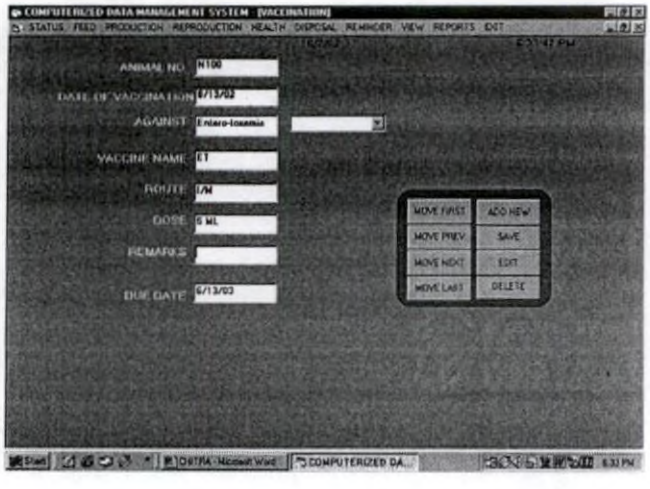



Fig. 4.33 Vaccination submenu



#### 4.3.7.6 Deworming and dipping

Fig.4.34 and 4.35 explain the structure of deworming and dipping submenus respectively. These submenus provided informations about animal number, date of deworming/dipping, dewormer/dipping solution used, dose, results and due date for next deworming/dipping.

### 4.3.8 Disposal

Disposal menu contained mortality, post mortem, sales, transfer and culling, milk, and manure submenus. There were provisions to 'move first', 'previous', 'last' and 'next' records and 'save', 'delete' and 'edit' the records in all the seven submenus.

#### 4.3.8.1 Mortality

This submenu was included to record animal number, sex, date of birth, date of death, cause of death and remarks. The format is shown in fig.4.36.

#### 4.3.8.2 Post mortem report

This submenu allowed to record the animal number, sex, date of birth, date of death, cause of death, post mortem report number, post mortem findings and remarks. The details are shown in fig.4.37.

#### 4.3.8.3 Sales, transfer and culling

These submenu can be selected for recording the sales, transfer and culling of the animals. As it could be observed from fig.4.38, 4.39 and 4.40, there was a common provision for input and retrieving the date of

Fig. 4.34 Deworming submenu

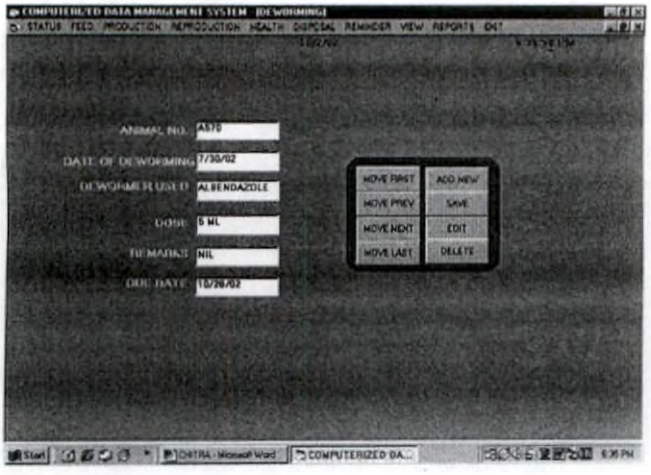



Fig. 4.35 Dipping submenu

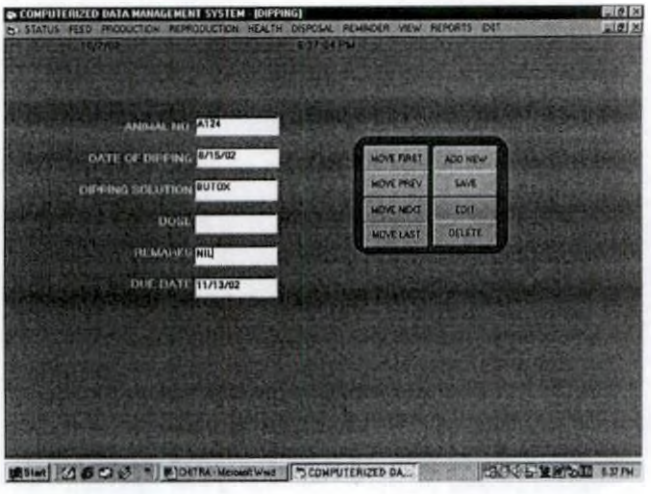



Fig. 4.36 Mortality submenu

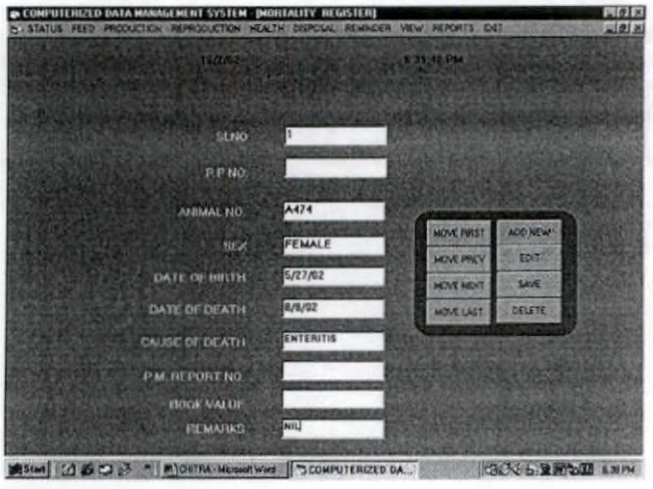


Fig. 4.37 Postmortem submenu

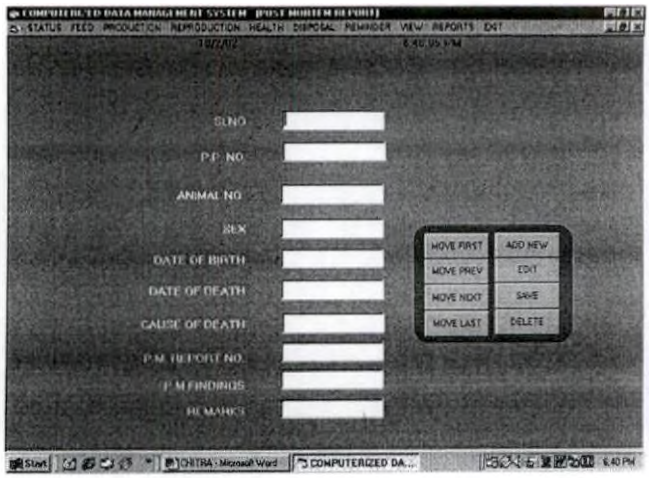



Fig. 4.38 Sales submenu

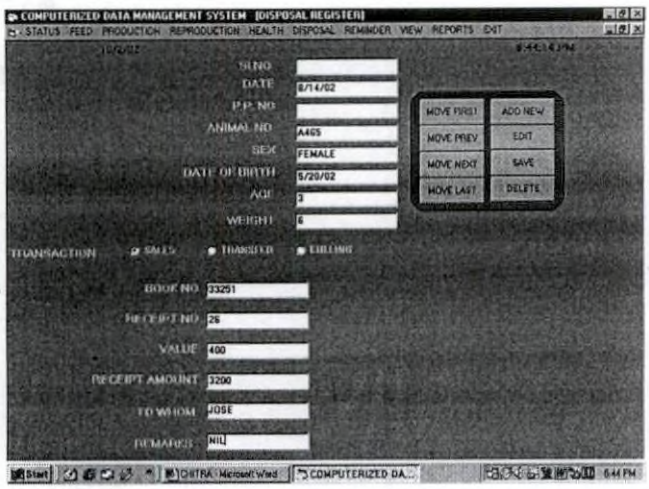
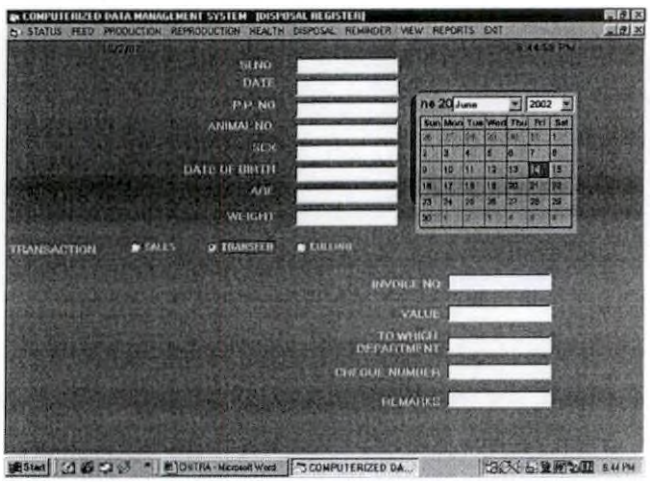



Fig. 4.39 Transfer submenu



sales/transfer/culling, animal number, sex, date of birth, age and weight of the animal.

Sales submenu showed additional data inputs such as book and receipt number, value of the animal, amount received, to whom the animals were sold and remarks. Transfer and culling submenus possessed invoice number, name of department to which the animal was transferred, cheque number and remarks. In addition, reason for culling was given in culling submenu.

#### 4.3.8.4. Milk

The data regarding disposal of milk were entered in format as shown in fig.4.41. The inputs included date of disposal, milk yield in morning and evening, total milk yield, coupon sales, quantity of milk fed to kids, sales to other departments, quantity of balanced milk, total quantity sold, price per litre, income from milk and remarks.

#### 4.3.8.5 Manure

The format for entering the data regarding manure disposal is illustrated in fig.4.42. The inputs were date of disposal, invoice number, to whom issued, quantity issued, cheque number and remarks.

### 4.3.9 Reminder

This submenu provided due date, a list of animal numbers and total number of animals on a particular due date and a list of reminders such as heat, service, kidding, dry off, treatment, vaccination, inoculative tests, deworming, dipping and weaning. The details are shown in fig.4.43.

Fig. 4.40 Culling submenu


Fig. 4.41 Milk disposal submenu

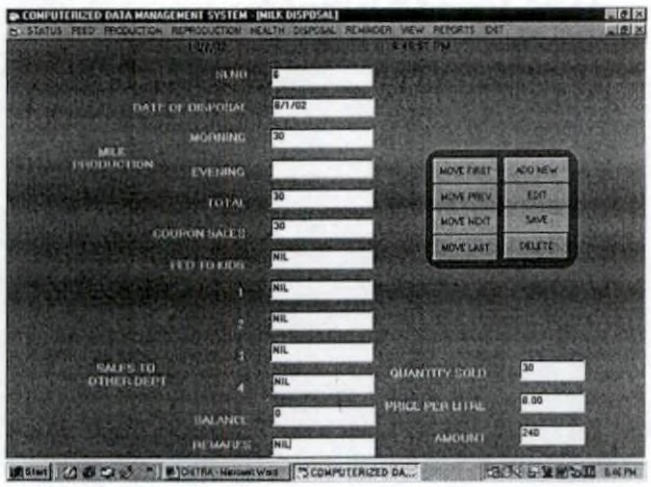
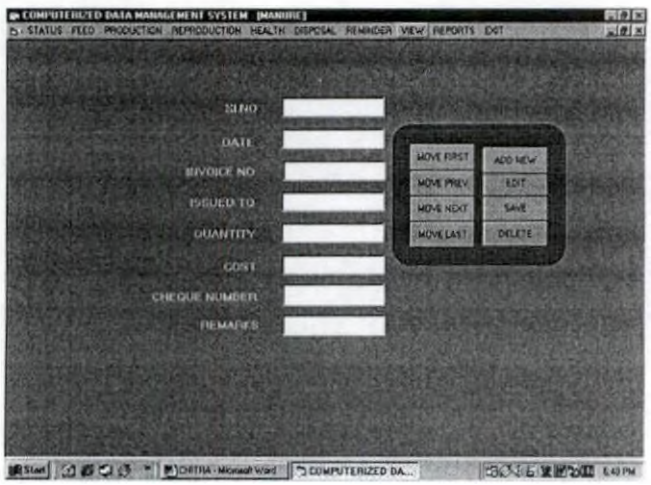



Fig. 4.42 Manure submenu



### 4.3.10 View

This submenu was formatted to view the tables such as kids, young stock, adult stock, total stock, daily stock, medicine stock, miscellaneous articles stock, feeds, weighing, milk recording, weaning, oestrous, service, kidding, diseases, treatment, test, inoculative test, vaccination, deworming, dipping, mortality, post mortem, milk disposal, manure disposal and sales, transfer and culling of animals. The details of various submenu are shown in fig.4.44

### 4.3.11 Reports

The report menu was provided with details of all livestock, adult stock, young, total stock, birth, sale of animal, mortality, feed, production and reproduction performance of a particular animal, farm income, service report and breeding efficiency reports. Fig.4.45 explains the details of submenus in the report menu.

## 4.4. Evaluation of computerized data management system

### 4.4.1. Time requirement for day-to-day entry

It could be observed from table 4.5 that the average time required to enter a set of entries in kids, medicine stock, miscellaneous articles, feed, milk recording and service in the computerized data management system were 19.17 $\pm$ 0.81, 20.75 $\pm$ 0.69, 21.81 $\pm$ 0.71, 26.19 $\pm$ 0.79, 11.67 $\pm$ 0.84 and 22.67 $\pm$ 0.99 seconds respectively.

Fig. 4.43 Reminder submenu

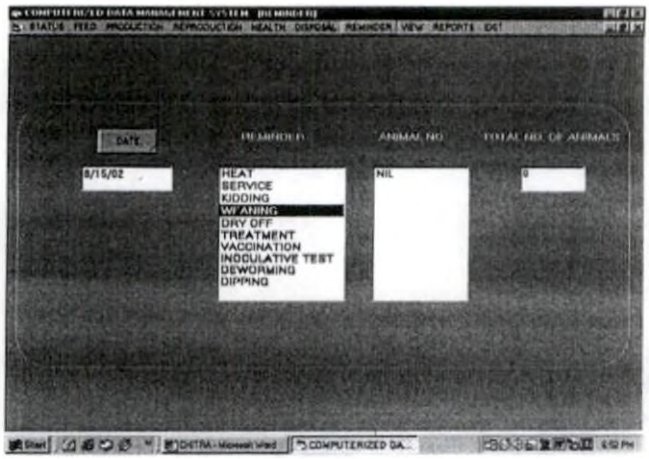



Fig. 4.44 View Submenu


Fig. 4.45 Report Submenu

**Table 4.5. Time required in seconds to enter a set of data in six records in the computerized data management system**

| Number of set of entries | Kids record | Medicine stock record | Miscellaneous articles stock record | Feeds record | Milk recording | Service record |
|---|---|---|---|---|---|---|
| I | 19.50±0.84 | 20.67±0.82 | 21.83±0.75 | 26.33±0.82 | 11.67±0.82 | 22.33±0.82 |
| II | 19.50±1.05 | 20.83±0.75 | 21.83±0.75 | 26.33±0.82 | 11.83±0.75 | 22.50±1.23 |
| III | 19.17±0.75 | 20.83±0.75 | 21.83±0.75 | 26.33±0.82 | 11.67±0.82 | 22.83±0.98 |
| IV | 18.83±0.75 | 20.67±0.82 | 21.67±0.82 | 26.17±0.75 | 11.83±0.75 | 22.67±1.03 |
| V | 18.83±0.75 | 20.50±0.55 | 21.83±0.75 | 26.00±0.89 | 11.33±1.03 | 23.00±1.10 |
| VI | 19.17±0.75 | 21.00±0.63 | 21.83±0.75 | 26.00±0.89 | 11.33±1.03 | 22.67±1.03 |
| **Average** | 19.17±0.81 | 20.75±0.69 | 21.81±0.71 | 26.19±0.79 | 11.67±0.84 | 22.67±0.99 |

(Mean ±Standard deviation) ($n$=6)

Average time required for entering a set of entries in milk disposal, mortality and sales, transfer and culling records in the computerized system were found to be 24.00 ± 0.68, 25.64 ± 0.08 and 27.50 ± 0.61 seconds respectively (table 4.6).

### 4.4.2 Event-wise recording

Average time required for recording a set of entries in kidding, mortality, sale of animals, breeding and milking events were found to be 44.08 ± 0.94, 25.64 ± 0.80, 27.50 ± 0.61, 22.67 ± 0.99 and 32.92 ± 1.38 seconds respectively in the computerized data management system (table 4.7).

### 4.4.3 Data retrievability

Time taken to get data on population status, feed ingredients, total quantity of feed, number of animals bred, kidding, total milk production, milk disposal, mortality and sales, transfer and culling are presented in table 4.8.

## 4.5 Comparison of the existing system with the computerized data management system

### 4.5.1 Time requirement for day-to-day entry

Comparative analysis of time required to enter a set of entries in birth, medicine stock, miscellaneous stock, feed, and breeding registers in existing and computerized data management system is given in table 4.9.

Average time required for entering a set of entries in the computerized data management system was significantly ($P<0.01$) less than that of the

**Table 4.6 Time required in seconds to enter a set of data in three records in the computerized data management system**

| Number of set of entries | Milk disposal records | Mortality records | Sales/transfer/ culling records |
|---|---|---|---|
| I | 23.83±0.75 | 25.33±0.82 | 27.17±0.75 |
| II | 24.00±0.63 | 25.50±0.55 | 27.33±0.82 |
| III | 24.00±0.63 | 25.50±1.23 | 27.67±0.58 |
| IV | 23.83±0.75 | 25.67±0.52 | 27.50±0.55 |
| V | 24.00±0.89 | 26.00±0.63 | 27.67±0.52 |
| VI | 24.33±0.52 | 25.83±0.98 | 27.67±0.52 |
| Average | 24.00±0.68 | 25.64±0.80 | 27.50±0.61 |

(Mean ± standard deviation) (n=6)

**Table 4.7. Time required in seconds to enter a set of data in five events in the computerized data management system**

| Number of set of entries | Kidding | Mortality | Sales | Breeding | Milking |
|---|---|---|---|---|---|
| I | 44.17±1.17 | 25.33±0.82 | 27.17±0.75 | 22.33±0.82 | 32.50±1.05 |
| II | 44.33±0.82 | 25.50±0.55 | 27.33±0.82 | 22.50±1.23 | 33.33±1.03 |
| III | 44.50±6.89 | 25.50±1.23 | 27.67±0.58 | 22.83±0.98 | 33.00±1.41 |
| IV | 44.17±0.75 | 25.67±0.52 | 27.50±0.55 | 22.67±1.03 | 33.17±2.14 |
| V | 44.00±0.89 | 26.00±0.63 | 27.67±0.52 | 23.00±1.10 | 32.67±1.63 |
| VI | 43.83±1.33 | 25.83±0.98 | 27.67±0.52 | 22.67±1.03 | 32.83±1.67 |
| Average | 44.08±0.94 | 25.64±0.80 | 27.50±0.61 | 22.67±0.99 | 32.92±1.38 |

(Mean ± Standard deviation) (n=6)

**Table 4.8 Data retrievability in seconds in the computerized data management system**

| Sl. No. | Data to be available at a particular period | Data retrievability |
|---|---|---|
| 1 | Populations status | 16.00 ±1.27 |
| 2 | Feed ingredients | 17.67 ±2.25 |
| 3 | Total quantity of feed fed to the animal | 22.67 ±1.37 |
| 4 | Number of animals bred | 22.50 ±1.05 |
| 5 | Kidding | 16.33 ±1.21 |
| 6 | Total milk production | 15.50 ±0.55 |
| 7 | Milk disposal | 15.50 ±0.55 |
| 8 | Mortality | 20.00 ±1.41 |
| 9 | Sale, transfer and culling of animal | 19.67 ±1.63 |
| 10 | Medicine and miscellaneous articles stock | 27.02 ±1.72 |

(Mean ± standard deviation) (n=6)

**Table 4.9 Comparative analysis of time requirement in seconds to enter a set of entries in four registers in both manual system (MS) and computerized data management system (CDMS) in the goat farm**

| Number of set of entries | Birth register | | | Medicine stock register | | | Miscellaneous article register | | | Feeds | | | Breeding | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | CDMS | 't' value | MS | CDMS | 't' value | MS | CDMS | 't' value | MS | CDMS | 't' value | MS | CDMS | 't' value |
| I | 34.83± 0.75[a] | 19.50± 0.84[b] | 33.37 | 30.83± 1.17[a] | 20.67± 0.82[b] | 17.46 | 32.33± 1.03[a] | 21.83± 0.75[b] | 20.12 | 15.33± 1.03[a] | 22.33± 0.82[b] | 13.02 | 33.33± 1.03[a] | 26.33± 0.62[b] | 19.02 |
| II | 34.17± 0.75[a] | 19.50± 1.05[b] | 27.83 | 31.17± 0.75[a] | 20.83± 0.75[b] | 23.78 | 32.17± 0.28[a] | 21.63± 0.75[b] | 20.44 | 15.17± 1.17[a] | 22.50± 1.23[b] | 10.61 | 33.00± 1.41[a] | 26.33± 0.82[b] | 10.00 |
| III | 34.50± 1.05[a] | 19.17± 0.75[b] | 29.09 | 30.67± 1.51[a] | 20.83± 0.75[b] | 14.31 | 32.17± 1.17[a] | 21.83± 0.75[b] | 18.20 | 15.17± 1.17[a] | 22.83± 0.98[b] | 12.29 | 32.83± 1.71[a] | 26.33± 0.82[b] | 11.17 |
| IV | 34.83± 0.75[a] | 18.83± 0.75[b] | 36.81 | 30.33± 1.21[a] | 20.67± 0.82[b] | 16.21 | 31.67± 1.21[a] | 21.67± 0.82[b] | 16.77 | 15.17± 1.17[a] | 22.67± 1.03[b] | 11.78 | 32.67± 1.03[a] | 26.17± 0.75[b] | 12.46 |
| V | 34.83± 0.75[a] | 18.83± 0.75[b] | 36.81 | 31.17± 0.75[a] | 20.50± 0.55[b] | 26.07 | 32.17± 1.17[a] | 21.83± 0.75[b] | 18.20 | 15.33± 1.03[a] | 23.00± 1.10[b] | 12.47 | 33.00± 0.89[a] | 26.00± 0.89[b] | 13.56 |
| VI | 34.83± 0.82[a] | 19.17± 0.75[b] | 33.45 | 31.00± 1.41[a] | 21.00± 0.63[b] | 15.81 | 31.83± 0.75[a] | 21.83± 0.75[b] | 23.01 | 15.50± 1.05[a] | 22.67± 1.03[b] | 11.93 | 32.83± 1.17[a] | 26.00± 0.89[b] | 11.37 |
| Average | 34.58± 0.81[a] | 19.17± 0.81[b] | 80.91 | 30.86± 1.13[a] | 20.75± 0.69[b] | 45.93 | 32.06± 1.01[a] | 21.81± 0.71[b] | 49.73 | 15.28± 1.03[a] | 22.67± 0.99[b] | 31.08 | 32.94± 1.07[a] | 26.19± 0.79[b] | 30.55 |

Mean ± standard deviation in rows bearing difference superscripts for each register differ significantly ($P<0.01$) (n=6)

existing system except breeding register which required more time in the computerized data management system than in the existing system.

In the existing system, time required to enter a set of entries were found to be 34.58 ± 0.81, 30.86 ± 1.13, 32.06 ± 1.01, 15.50 ± 1.05 and 32.94 ± 1.07 seconds in birth, medicine stock, miscellaneous stock, feed and breeding register respectively whereas in the computerized data management system it required 19.17 ± 0.81, 20.756 ± 0.69, 21.81 ± 0.71, 22.67 ± 0.99 and 26.19 ± 0.79 seconds.

### 4.5.2 Event-wise recording

It could be observed from table 4.10 that the average time required to record a set of entries in each event in the existing system significantly ($P<0.01$) differed from that of CDMS. Time required to enter a set of entries in kidding, mortality, sales, breeding events were found to be 67.33 1.69, 47.47 ± 1.52, 57.36 ± 1.48 and 34.88 ± 0.81, and 44.08 ± 0.94, 25.64 ± 0.80, 27.50 ± 0.61 and 22.67 ± 0.99 seconds in the existing and computerized data management system, respectively, except for milking event which took more time (32.92 ± 1.38 seconds) in CDMS than existing system (18.39 ± 1.08 seconds).

### 4.5.3 Data retrievability

The present study revealed that there was a significant difference ($P<0.01$) between the existing and computerized data management system in case of time required to retrieve the data (table 4.11).

**Table 4.10. Comparative analysis of time requirement in seconds to enter a set of entries in five events in both manual system (MS) and computerized data management system (CDMS) in the goat farm**

| Number of set of entries | Kidding | | | Mortality | | | Sales | | | Breeding | | | Milking | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | CDMS | 't' value | MS | CDMS | 't' value | MS | CDMS | 't' value | MS | CDMS | 't' value | MS | CDMS | 't' value |
| I | 66.50± 1.64[a] | 44.17± 1.17[b] | 27.13 | 46.83± 1.03[a] | 25.33± 0.82[b] | 31.29 | 56.76± 1.63[a] | 27.17± 0.75[b] | 40.19 | 34.83± 0.75[a] | 22.33± 0.82[b] | 13.02 | 18.50± 1.38[a] | 32.50± 1.05[b] | 19.80 |
| II | 67.00± 2.10[a] | 44.33± 0.82[b] | 24.66 | 48.00± 1.41[a] | 25.50± 0.55[b] | 36.34 | 57.00± 1.79[a] | 27.33± 0.82[b] | 36.96 | 34.17± 0.75[a] | 22.50± 1.23[b] | 10.61 | 18.33± 1.21[a] | 33.33± 1.03[b] | 23.08 |
| III | 67.17± 2.32[a] | 44.00± 0.89[b] | 22.85 | 47.33± 1.63[a] | 25.50± 1.23[b] | 26.20 | 57.33± 1.86[a] | 27.67± 0.58[b] | 37.61 | 34.50± 1.05[a] | 22.83± 0.98[b] | 12.29 | 18.17± 1.17[a] | 33. ± 1.41[b] | 19.80 |
| IV | 67.67± 1.63[a] | 44.17± 0.75[b] | 32.01 | 47.67± 1.51[a] | 25.67± 0.52[b] | 33.86 | 58.00± 0.89[a] | 27.50± 0.55[b] | 71.23 | 34.83± 0.75[a] | 22.67± 1.03[b] | 11.78 | 18.50± 1.05[a] | 33.17± 2.14[b] | 15.09 |
| V | 67.67± 1.03[a] | 44.00± 0.89[b] | 42.43 | 47.33± 2.16[a] | 26.00± 0.63[b] | 23.22 | 57.50± 1.64[a] | 27.67± 0.52[b] | 42.43 | 34.83± 0.75[a] | 23.08± 1.10[b] | 12.47 | 18.33± 1.03[a] | 32.67± 1.63[b] | 18.17 |
| VI | 68.00± 1.41[a] | 43.83± 1.33[b] | 30.50 | 47.67± 1.21[a] | 25.83± 0.98[b] | 34.28 | 57.67± 1.03[a] | 27.67± 0.52[b] | 63.64 | 34.33± 0.83[a] | 22.67± 1.03[b] | 11.93 | 18.50± 1.05[a] | 32.83± 1.61[b] | 22.35 |
| Average | 67.33± 1.69[a] | 44.08± 0.94[b] | 72.18 | 47.47± 1.52[a] | 25.64± 0.80[b] | 76.28 | 57.36± 1.48[a] | 27.50± 0.61[b] | 112.16 | 34.58± 0.81[a] | 22.67± 0.99[b] | 31.08 | 18.39± 1.08[a] | 32.92± 1.38[b] | 49.78 |

Mean ± standard deviation in rows for each event in the existing manual system and computerized data management system differ significantly bearing different superscripts ($P<0.01$) (n=6)

**Table 4.11 Comparative analysis of time requirement in seconds to get data in the manual system and computerized data management system (CDMS) in the goat farm**

| Sl. No. | Data to be available at a particular period | MS | CDMS | 't' value |
|---|---|---|---|---|
| 1. | Population status | 185.83±7.36[a] | 16.00±1.27[b] | 55.71 |
| 2. | Feed ingredients | 35.33±4.97[a] | 17.67±2.25[b] | 7.94 |
| 3. | Total Quantity of feed fed to the animal | 39.33±5.01[a] | 22.67±1.37[b] | 7.87 |
| 4. | Number of animals bred | 98.83±6.83[a] | 22.50±1.05[b] | 26.88 |
| 5. | Kidding | 193.33±7.53[a] | 16.33±1.21[b] | 56.86 |
| 6. | Total milk production | 18.67±1.51[a] | 15.50±0.55[b] | 4.84 |
| 7. | Milk disposal | 18.67±2.50[a] | 15.50±0.55[b] | 3.027 |
| 8. | Mortality | 310.83±7.36[a] | 20.00±1.41[b] | 95.056 |
| 9. | Sales transfer and culling | 315.00±11.83[a] | 19.67±1.63[b] | 60.57 |
| 10. | Medicine and Miscellaneous articles | 135.00±10.72[a] | 27.02±1.72[b] | 33.21 |

Mean ± standard deviation in rows bearing different superscripts for each data differ significantly ($P<0.01$).

# *Discussion*

# 5. DISCUSSION

## 5.1 Evaluation of the existing system

### 5.1.1 Time requirement for day-to-day entry

Time required to enter a set of data in the existing registers ranged from 15.28 ± 1.03 to 34.58 ± 0.81 seconds. Among eight registers maintained in the goat farm, manual entries made in birth register took more time (34.58 ± 0.81 seconds) and breeding registers required less time (15.28 ± 1.03 seconds). It might be due to the requirement of more entries in the birth register and less entries in the breeding register.

### 5.1.2 Event-wise recording

Average time requirement to record a set of data ranged from 15.28 ± 1.03 seconds to 67.33 ± 1.69 seconds for mortality event and for breeding event. Mortality events required more time to enter data. It might be due to the need of repeated entries in both mortality and disposal register and livestock register. Breeding event required less time since it needed only breeding register for recording it.

### 5.1.3 Data retrievability

Time taken to retrieve data from the existing system varied from 18.67 ± 1.51 seconds to 315.00 ± 11.83 seconds. The details of sales, transfer and culling of animal took more time to be retrieved them since it needed verification of two registers *viz.*, mortality and disposal and livestock, whereas

the details of milk production required less time for data retrievability because of verification of one register (milk recording and disposal).

## 5.2 Identification of input requirement

The input requirement identified for developing CDMS were options for entering details of stocks including animals, medicine and miscellaneous article, feeding, production and reproduction performance, health details and disposal of animals, milk and manure. Accordingly main menu namely status, feeds, production, reproduction, health, disposal, reminder, view and report. Similar input requirement for developing computer programme were suggested by Lees *et al.* (1993) and Basheer (2001).

## 5.3 Development of computerized data management system (CDMS)

### 5.3.1 Login page

A login page requiring the 'user name' and 'password' to login is provided in the CDMS. This prevents the unauthorized access to the program, and willful or ignorant changes of the valuable data. This is in resemblance with the report of Miller (1981) who stated that passwords are an essential feature to discourage unauthorized or irresponsible access to the program rather than total prevention.

### 5.3.2 Main menu

A menu consisting of status, feeding, production, reproduction, health, disposal view, reports and exit was provided to operate CDMS. Udompraset and Williamson (1990) opined that menu system was easy to use and they

developed a computer programme Dairy CHAMP by using menu system, in which the main menu contained several choices such as animal data structure including animal events, cow record, bull record and cow database submenus and farm data structure including inventory records, farm event, farm record and farm parameter record submenus. In the present system also, the main menu designed is in agreement with the above structure.

### 5.3.3 Status

The status was further divided into submenus of kids, young stock, adult stock, total stock, daily stock, medicine and miscellaneous articles records.

A similar type of menu and its further division were used to record the birth or arrival details of non human primate colony in computerized record system (Beland *et al.*, 1981). In computerized herd recording system of cattle, the menu system was used (Miller, 1981).

A cow record consisting of identification number of animals, date of birth animal type and details of drug inventories were presented in Dairy CHAMP designed by Udompraset and Williamson (1990). Lees *et al.* (1993) recorded new animal locations and removed culled or dead animals from the current inventory in his computer data base programme for managing research animals called CRITTER, while Sparhr *et al.* (1993) included herd number, location and birth date of dairy animals in Dairybase, an electronic individual animal inventory and herd management system.

### 5.3.4 Feed

Feed menu constituted feeds and feed requirement submenus.

The details of purchase and issue of feed could be included in feeds submenu and requirement of feed, actual feeding and deficient feeding for each animal and group of animals could be obtained in 'feed requirement' submenu. Similar classification were used by Basheer (2001).

Stallings *et al.* (1985) provided information about group name, number of animals in the group, feed requirements, weight of animals and amount of feeds to be fed per animal per day in his computer ration evaluation program for heifer, breeding female cattle. This is in agreement with the present study.

Udompraset and Williamson (1990) included purchase and issue particulars of feed in their computer programme. The present system is also more comprehensive and suitable for the existing purchase and utilization pattern of feed in the state. Schofield et al. (1990) provided an option in their computer programme 'FeedByte' for calculating feed requirement for growing animals. Similar option was also available in the present system.

### 5.3.5 Production

Weighing, growth chart, milk recording, milk chart and weaning menus were presented in the production menu.

Information on average daily weight gain and weight at weaning could be obtained from weighing and weaning submenus respectively. This was ascribed by Miller (1981) Menzies (1992) and Ringwall and Boggs (1992),

who furnished details of live weight gain/day, number of animals weaned, average weaning weight and gross weaning weight in their computer programmes developed for beef cattle production.

Udompraset and Williamson (1990) designed heifer growth chart to help farmers and veterinarians to detect problems and to monitor various aspects of a farm. Similar provision was given in the presently developed computerized data management system.

Milk yield of individual goats could be entered in the presently developed computer programmes. Several authors developed computer programmes to enter milk yield of individual cows and to get milk production trend in a herd. (Martin *et al.*, 1982; Spahr *et al.*, 1993; Asseldonk *et al.*, 1998; Hayes *et al.*, 1998 and Pietersma *et al.*, 1998).

The milk chart was designed in the present study to know the milk production trend of individual goat. This is supported by Enevoldsen *et al.* (1995) who designed lactation curves in the computer programme on similar lines of the present system.

### 5.3.6 Reproduction

Reproduction menu contained oestrous, service and kidding submenus.

The present program provided the option to record the date of heat observed, date of examination of heat and proable date of heat in the oestrous submenu. Erb *et al.* (1975), Lineweaver and Spessard (1975), Speicher (1981),

Martin *et al.* (1982) and Spahr *et al.*, (1983) had incorporated the details of oestrous in computerized reproductive management program.

Events such as breeding and pregnancy diagnosis and probable date of kidding were entered in the service submenu. Martin *et al.* (1982) and Lees *et al.* (1993) had also entered the data of breeding and pregnancy diagnosis of dairy cows into the reproductive section of their computer programmes.

Information about kidding date, parity number, kidding interval, kids type and probable date of dry off could be stored in the kidding submenu. Similar options were used by Devanand (1995) and Hayes *et al.* (1998) to record calving details of dairy cows.

Reproductive inefficiency is a major economic loss to most dairymen. Studies during the past several years illustrated clearly the need for a complete, computerized record system for reproductive management. The reproductive management profile was developed in the present programme to provide the farmer with a current and complete reproductive record on each animal in the farm.

### 5.3.7 Health

A complete medical history of diseases, treatments and preventive therapies could be recorded in the Health menu.

The diseases submenu was provided to register clinical information of sick animals with a link to treatment submenu. Similar provision was made in

CRITTER (data base for managing research animals) (Lees *et al.*, 1993 and Dairy herd management system (Basheer, 2001).

Routine preventive interventions, such as diagnostic, inoculative tests, vaccination, deworming and dipping were recorded in the respective submenus. Lees *et al.* (1993) and Basheer (2001) designed similar options to record the preventive interventions in the computer programme used for managing dairy cows.

Beland *et al.* (1981) and Speicher (1981) developed computer-based animal record system in a non-human primate colony and computerized data acquisition systems for dairy herd management, respectively in which they stored the details of treatment and preventive measures. This is in close agreement with the present study.

This system provides the information that has not been readily available in the past, which helps to monitor the health status of herd and identifies problem areas. Previous studies revealed that dairy practitioner, dairy clients and farm manager benefited economically when computerized herd health was used rather than manual herd health (Ko and Stalheim, 1992).

### 5.3.8 Disposal

Disposal menus provide options for removing culled, dead and sold animals from the current inventory, recording postmortem details milk and manure sale.

When dead and culled animals were removed from the current inventory, the cause of death and reason for culling could be recorded in the mortality and culling submenus respectively. Miller (1981) designed a computer programme with similar menu system for getting the report of culled and mortality of sows.

Thrusfield (1985) reported that computers could be used for storing results of postmortem examinations and Das (1986) explained the uses of computers in mother dairy in the area of sales of milk. These findings agree with the present study.

### 5.3.9 Reminder

This submenu allowed to view various significant practices to be carried out in the farm at appropriate timings, namely due for heat, service, kidding, dry off, weaning, vaccination, deworming, dipping and inoculative tests. Similar options were suggested by several authors (Sard, 1981; Thrusfield, 1985 and Coutts, 1998).

Farber (1989) reported that computers could save money and time with regard to reminder system and there was no way that a manual system could be as effective as a computerized system when it came to effectively controlling reminders.

### 5.3.10 View

This menu allowed to view all the tables included in the back file such as kids, youngstock, adult stock, total stock, medicine stock, miscellaneous

stock, weighing, milk recording, weaning, feeds, heat, service, kidding, treatment, illness, preventive interventions, mortality, postmortem report, disposal of milk and manure and sale, transfer, and culling of animal. Similar option was designed by Basheer (2001) in a software 'Dairy herd management system'.

### 5.3.11 Reports

The reporting system in a farm helps to know the day-to-day activities of the farm, the present day livestock position with regard to their age, sex, type, productive and reproductive status (Lees *et al.*, 1993). The manual reporting system is deficient in producing the above said information because of its poor retrieving capacity and the tailoring of reports could be a laborious process. The speed of report generation could be improved by upgrading the hardware and software (Coutts, 1998).

The present study provided reports on animal strength, feed status, production and reproduction performance of a particular animal, service report, breeding efficiency and farm income. Similar provision were made available in Dairy herd management system (Basheer, 2001). Lees *et al.* (1993) also designed report section in their computer programme 'CRITTER' for managing research animals.

## 5.4 Evaluation of the computerized data management system

### 5.4.1 Time requirement for day-to-day entry

Time required to enter a set of entries varied from 11.67 ± 0.84 seconds (milk recording) and 27.50 ± 0.61 (sales, transfer and culling) seconds. The latter required more data input which lead to more time involvement to enter data and the former required less data input which lead to less time requirement, to enter data.

### 5.4.2 Event-wise recording

Average time required to enter a set of data ranged from 22.67 ± 0.99 seconds (breeding event) to 44.08 ± 0.94 seconds (kidding events). Entry of more data in the latter event lead to more time involvement and entry of less data and automatic update facility lead to less time involvement in the former event.

### 5.4.3 Data retrievability

Time taken to retrieve data from the computerized data management system varied form 27.02 ± 1.72 seconds to 15.50 ± 0.55 seconds. Since the updating facilities were not available in the medicine and miscellaneous article records, it required more time to retrieve the details of these records. Data retrievability on milk production and disposal was very quick because of the automatic calculation in the milk recording and disposal record.

## 5.5 Comparison of the existing system with the computerized data management system.

### 5.5.1 Time requirement for day-to-day entry

The present study revealed that time requirement for day-to-day entry in birth, medicine stock, miscellaneous stock, feed and breeding registers in the existing system were significantly ($P<0.01$) higher than that of the computerized data management system. Time taken in the existing system was more than that of CDMS except breeding registers in which existing system required less time than the CDMS. It may be due to more data input requirement in CDMS and less data entry in the existing system.

### 5.5.2 Event-wise recording

There was a significant difference between existing system and CDMS regarding time requirement for entering kidding, mortality, sales, breeding and milking events in the respective registers. All events except milking event required more time for entering in the existing system than CDMS where as milking event took more time for entering in CDMS since two records *viz.* milk recording and milk disposal had to be entered. Automatic updating provision might be the reason for taking less time to enter other events in CDMS.

In the manual system, many number of separate registers necessitated repeated entries of the same data in different registers. This required more man power and administrative backup. This is in agreement with Sard (1981)

who reported that manual recording was laborious and time consuming method.

In the presently developed CDMS, all the registers were maintained in a file and it require only the click of a button to move from one record to another. Lazarus and Smith (1988) observed an increased managerial time in the case of manual record keeping when compared to computerized record keeping. It supports the findings of present study.

Udompraset and Williamson (1990) expressed that manual recording system would be inefficient in the increasing scale of production. Chang *et al.* (1992) stated that computers could effectively reduce time and effort required to collect and record the data and Cleary *et al.* (1999) reported that computerized record keeping had significant improvement over manual data recording. Bhatt *et al.* (2000) opined that computerized data recording could help the farmer in saving time and making the things simpler and easier. These findings follow the result of present study.

### 5.5.3 Data retrievability

Data retrievability for all parameters of stock, production and disposal in the existing system were significantly lower ($P<0.01$) from that of CDMS. In CDMS, computing is done by the machine but in the existing system manual calculations are required. Hence the manual record keeping took more time in data retrievability.

Erb *et al.* (1975) reported that the system was useful for decisions of herd management and was especially efficient for retrieving data on animals and controlled research trials. Sard (1981) noted that storage and retrieval of clinical records on a computerized system was found practical and economical in human general practice. Farber (1989) asserted that many hours were spent in calculating data manually for management purposes. These hold true in the present investigation also.

Bennett (1991) reported that computerized management system would be efficient in rapid and easy access to reference data and flexibility in data retrieval. Thirunavukkarasu (2000) noted that computers are an efficient means of storing, analyzing and retrieving data. Several authors found out that data retrievability by computers was more efficient than the manual record keeping (Palazzola 1996; Coutts 1998; Pietersma *et al.*, 1998 and Bhatt *et al.*, 2000).

In the traditional form of record keeping, the farm manager had to keep a large number of individual records relating to different activities of the farm. The different records with less integration between them made the record keeping tedious prolixity. The manual records maintained in the farm were usually overlapping, repetitive in content and voluminous, containing a lot of irrelevant details and obscure information narrated with a lack of well-defined focus. As a matter of fact, these records were often being managed for the sake of keeping without any productive retrieval at a later period for meaningful interpretation and effective decision-making.

The currently developed computerized data management system for goat farms is a menu driven, user-friendly system, which enables the farm supervisor to enter, store and retrieve the data relating to goat farm management at any point of time. Thus it will reduce man power requirement to keep the record of the produce and performance of each animal.

# *Summary*

# 6. SUMMARY

Kerala Agricultural University Sheep and Goat farm, representing a sample of organized farming of small ruminants, was selected for the present study. The existing registers of University Sheep and Goat farm were livestock register, birth register, breeding register, disposal and mortality register, milk recording and disposal register, feed register, medicine stock register and miscellaneous stock register.

Time requirement to enter a set of entries in the existing registers was measured. Time required to record a set of entries in each events kidding, mortality, breeding, sales and milking was calculated. Data retrievability in the existing manual system was measured. Input requirements were determined based upon the data to be stored and the data to be obtained from the proposed computerized data management system (CDMS).

Based on the information collected and anticipated reports required for an efficient goat farm management, a combination of Visual Basic 6.0 as front end tool and Microsoft Access 97 as back end tool were used. Computerised data management system for goat farms is structured under a main menu with various menus such as status, feed, production, reproduction, health, view reminder, reports and exit.

The status menu under the main menu allows the user to record and retrieve various categories of animals. It is further divided into kids, young

stock, adult stock, total stock, daily stock, medicine stock and miscellaneous article stock options. The feed menus has feeds and feed requirement submenus. Feeds sub menu allows the user to record purchase and issue details of feeds and feed requirement submenu gives details about nutritional requirement of various categories of animals.

The production submenu is divided into weighing, growth chart, milk recording, milk chart and weaning for recording weighing measurement, calculating average daily weight gain, growth trend of an animal, milk yield, milk production trend of an animal and weaning details respectively.

Reproductive menu is segmented into oestrous, service and kidding. Date of heat and expected date of next heat can be recorded and obtained from oestrous option. Service option allows the user to get details about date of service, pregnancy diagnosis and expected date of kidding. Kidding details can be stored in the kidding option. Kidding interval, parity details and dry off date can be obtained from this submenu.

Reminder menu is designed to obtain the checklists of animals due for vaccination, treatment, deworming, dipping, heat, service, kidding, weaning and dry off. View menu can display all the recorded information under various tables. Report menu is designed for obtaining animal strength, disposal details, feed details, production and reproduction performance, service report, breeding efficiency and farm income.

The developed computerized data management system for goat farm was evaluated by time requirement to enter a set of entries, time required to record each event and data retrievability in the CDMS.

Comparison of the existing system with CDMS was carried out. It revealed that time requirement for day-to-day entry in birth, medicine stock, miscellaneous stock, feed and breeding registers in the existing system were significantly ($P<0.01$) differed from the CDMS. Since updating facilities are available in the CDMS it required less record to enter each event than the existing system. Time required to enter a set of entries in each in the existing system were also significantly ($P<0.01$) differed from the CDMS. Time required to retrieve data from the existing system was significantly ($P<0.01$) higher than that of CDMS.

It could be concluded that the introduction of CDMS in the goat farm could effectively save the time required for day-to-day entry in the registers and could increase the speed and accuracy of data retrievability inturn it leads to improvement in the efficiency of farm management.

# *References*

# REFERENCES


Amle, M.B. and Mhase, P.P. 2001. Contribution of goat to the Indian economy. *Indian Dairyman* **53**(8): 65-67

Asseldonk, M.A.P.M.V., Huirne, R.B.M., Dijkhuizen, A.A., Beulens, A.J.M. 1999. Dynamic Programmes to determine optimum investments in information technology on dairy farms. *Agric. Syst.* **6**: 17-28

Bandyopadhyay, S. and Rajkhowa, C. 1997. Haemonchus: A computer programme for haemonchosis in animals. *Indian J. Anim. Sci.* **67**(8): 684

Bandyopadhyay, S., Rajkhowa, C. and Hazarika, U.K. 1996. A computer programme for identification of parasite eggs and larvae. *J. Vet. Parasit.* **10**(2): 197-199

Barrow, M. 1995. Computerisation – defining the way ahead. *In Pract.* **17**(10): 384-388

Basheer, M. 2001. Developing a computerized dairy herd management. M.V.Sc. thesis, Tamil Nadu Veterinary and Animal Sciences University, Chennai, p. 72

Beland, M.F., Bronson, R.T. and Peacock, W.C. 1981. Computer-based animal record system in a non-human private colony. *Am. J. Vet. Res.* **42**(8): 1456-1459

Bennett, P.M., Gascoyne, S.C., Hart, M.G., Kirkwood, J.K. and Hawkey, C.M. 1991. Development of LYNX: a computer application for disease diagnosis and health monitoring in wild mammals, birds and reptiles. *Vet. Rec.* **128**:496-499

Bhatt, P., Patra, R.C. and Gupta, S.K. 2000. Computers in veterinary practice. *The Veterinarian* **24**(6): 1-3

Blood, D.C. 1979. The D.I.T. Smith lecture series – 1979. The Veterinarian in planned animal health and production. *Can. Vet. J.* **20**: 341-347

Boydell, P. 2000. IT and the changing face of referral work. *In Pract.* **22**: 280-281

Capron, H.L. and Williams, B.K. 1982. *Computers and Data Processing*. A V Benjamin/Cummings Publishing Company Inc, California, p. 374

Chandler, P.T. and Martin, J.E. 1975. Computerized management information systems. *J. Dairy Sci.* **58**: 239-243

Chang, W., Barry, M.C. Jones, L.R. and Merrull, W.G. 1992. Compares: A computerized Milking Parlour Evaluation System. *J. Dairy. Sci.* **75**: 2578-2586

Cleary, F., Mc Grath,M.J., Gaiser, M., O'Coonor, J.F., Everard,M. and Holland, J. 1999. Development of a low cost data acquisition system for milk powder production line monitoring. *J. Dairy Sci.* **82**: 2039-2048

Collins, M.T., and Moran, I.R. 1991. Epidemiological model of paratuberculosis in dairy cattle. *Prev. Vet. Med.* **11**: 131-146

Coutts, F. 1998. Getting the most from your client database. *In Pract.* **20**: 467-470

Cowart, R. 1986. *The ABC's of Dbase III Plus.* BPB Publication, New Delhi, p.264

Das, S.K. 1986. Computer application at mother dairy: Delhi. *Indian Dairyman* **38**(1): 1-7

Dascanio, J.J., Shires, P.K., Croft, R.S., Thatcher, C.D. and Lewis, L.D. 1997. Multimedia case-simulation computer program for teaching veterinary nutrition. *J. Am. Vet. Med. Assoc.* **211**: 1380-1384

de Groot, B., Hoeggel, F.U. and Soni, R.L. 1993. Information management in a goat development program – experiences from Rajasthan. *Proceedings of a workshop on Information Systems for livestock research and development in India., 1-3 February, 1993* (eds. Manu, A. and de Groot, B.). Central and Sheep and Wool Research Institute, Avikanagar. pp.35-45

Dekkers, J.C.M. 1991. Estimation of economic values for dairy cattle breeding goals: bias due to sub-optional management policies. *Livest. Prod. Sci.* **29**: 131-149

Devanand, C.P. 1995. Management Information System on Bull Mother Herds. M.V.Sc. thesis, Kerala Agricultural University, Thrissur. p. 148

Dye, L., Harris, T., Ray, C.M. and Waldhalm, S. 1994. Computer use in private veterinary practice. *J. Am. Vet. Med. Ass.* **204**: 888-890

Ekesbo, I., Oltenacu, P.A., Vilson, B. and Nilsson, J. 1994. A disease monitoring system for dairy herds. *Vet. Rec.* **134**: 270-273

Elmore, R.G. 1990. Using a specialized computer program to track and analyse reproductive health in dairy herds. *Vet. Med.* **85**: 536-542

Ely, L.O., Froetschel, M.A., Mertens, D.R. and Nianogo, A.J. 1991. Economic replacement – a computer programme to teach the economic value of feed stuffs. *J. Dairy. Sci.* **74**: 2774-2784

Enevoldsen, C., Sorensen, J.T., Thysen, I., Guard, c. and Grohn, Y.T. 1995. A diagnostic and prognostic tool for epidemiologic and economic analysis of dairy herd health management. *J. Dairy Sci.* **78**: 947-961

Erb, R.E., Wolfe-selz, S. and Cappock, C.E. 1975. Computer summaries of life cycle data for cow research herds. *J. Dairy Sci.* **58**: 127-132

Erez, B. and Hartsock, T.G. 1990. A microcomputer photocell system to monitor periparturient activity of sows and transfer data to a remote location. *J. Anim. Sci.* **68**: 88-94

Esslemont, R.J. and Kossaibati, M.A. 2000. The use of data-bases to manage fertility. *Anim. Reprod. Sci.* 60-61: 725-741

Esslemont, R.J., Stephens, A.J. and Ellis, P.R. 1981. Daisy: Dairy Information system an aid to record keeping and health management. *Pro. Am. Ass. Bovine Pract.* **13**: 51-61

Farber, P.L. 1989. Introduction to practice management software. *Can. Vet. J.* **30**: 905-910

Fetrow, J., Harrington, B., Henry, E.T. and Anderson, K.L. 1988. Dairy herd health monitoring. Part II. A computer spreadsheet for dairy herd monitoring. *Compend. Contin. Edu. Pract. Vet.* **10**: 75-80

Frankena, K., Noordhuizen, J.P., Willeberg, P., van Voorthuysen, P.F. and Goelema, J.O. 1990. EPISCOPE: Computer programs in veterinary epidemiology. *Vet. Rec.* **126**: 573-576

Fraser, I. and Cordina, D. 1999. An application of data envelopment analysis to irrigated dairy farms in Northern Victoria, Australia. *Agric. Syst.* **59**: 267-282

Furman, J.W. and Hughes, M.A. 1992. Helping your producer clients develop master plans for their operations. *Vet. Med.* **87**: 160-165

Gafsi, M. 1999. A management approach to change on farm. *Agric. Syst.* **61**: 79-89

Galligan, T.D., Ferguson, D.J., Ramberg, F.C. and Chalupa, W. 1986. Dairy ration formulation and evaluation programme for microcomputer. *J. Dairy. Sci.* **69**:1656-1666

Gerrard, B. 1998a. Vets on the Net. 1. In the beginning *In Pract.* **20**: 463-465

Gerrard, B. 1998b. Vets on the Net. 2. Tools and Services. *In Pract.* **20**: 525-528

Gerrard, B. 1998c. Vets on the Net. 3. Present and future. *In Pract.* **20**: 602-606

Gerrard, B. 2001. IT in education and practice. What new graduates have come to expect. *In Pract.* **23**: 359-362

Gobar, G.M., Case, J.T. and Kass, P.H. 1998. Program for surveillance of causes of death of dogs, using the internet to survey small animal veterinarians. *J. Am. Vet. Med. Ass.* **213**: 251-256

Goodger, W. 1987. DairyComp. 305 program. *Vet. Clin. North Am.* [*Food Anim. Pract.*] **3**: 553-560

Hanks, J.D., Bedard, B.G., Navis, S., Akoso, B.T., Putt, S.N., James, A.D. and Heriyanto A. 1994. DIAG: A laboratory information management system developed for regional animal disease diagnostic laboratories in Indonesia. *Trop. Anim. Hlth. Prod.* **26**(1): 13-19

Hayes, D.P., Pfeiffer, D.U. and Morris, R.S. 1998. Production and reproductive responses to use of Dairyman: a management information system for New Zealand dairy herds. *J. Dairy Sci.* **81**: 2362-2368

Heald, C.W.,Kim, T., Sischo, W.M., Cooper, J.B. and Coolfgang, D.R. 2000. A computerized mastitis decisions aid using farm-based record: An artificial neural network approach. *J. Dairy Sci.* **83**: 711-720

Hutt, M.J. and Hutt, G.K. 1993. Organizing the human resource: A review of centralization, decentralization and delegation in agricultural business management. *J. Dairy. Sci.* **76**: 2069-2079

JongMyung, P., Euikyung, H., Incheon, K., Jaechin, R., Kyunkyu, C., Kuttwan, K., Park, J.M., Kwang, K.C., Kim, I.C., Rhee, J.C., Chung, H.K. and Kang, K.H. 1998. Programme for evaluation of diarrhoea in piglets. *Kor. J. Vet. Res.* **38**(1): 201-208

Kerr. D.V., Cowan, R.T. and Chaseling, J. 1999. DAIRYPRO – A knowledge-based decision support system for strategic planning on sub tropical dairy farms I. System description. *Agri. Syst.* **59**: 245-255

Kilpatrick, D.J. and Walker, N.1990. Computerized recording system for an experimental pig herds. *Comput. Electron. Agri.* **4**: 255-260

Ko, J.C.H. 1992. Vetcheck: A herd health computer program for small dairy herds. *Vet. Med.* **87**: 724-743

Ko, J.C.H. and Stalheim, P.S. 1992. Using a herd health computer program in your dairy practice. *Vet. Med.* **87**: 836-847

Lazarus, W.F. and Smith, T.R. 1988. Adoption of computers and consultant services by New York dairy farmers. *J. Dairy Sci.* **71**: 1667-1675

Lees, V.W., Lukey, C. and Orr, R. 1993. CRITTER: A database for managing research animals. *Can. Vet. J.* **34**: 28-32

Lescourret, F., Genest, M., Barnouin, J., Chassagne, M. and Faye, B. 1993. Data modeling for database design in production and health monitoring systems for dairy herd. *J. Dairy Sci.* **76**: 1053-1062

Lineweaver, J.A. and Spessard, G.W. 1975. Development and use of a computerized reproductive management programme in dairy herds. *J. Dairy Sci.* **58**: 256-261

Lissemore, K.D. 1989. The use of computers in dairy herd health programs: A review. *Can. Vet. J.* **30**: 631-635

Lissemore, K.D., Leslie, K.E., Menzies, P.I., Martin. S.W., Meek, A.H. and Etherington, W.G. 1992. Implementation and use of a microcomputer based management information system to monitor dairy herd performance. *Can. Vet. J.* **30**:114

Maehl, J.H.H. and Suryaprakasam,T.B. 1993. Approach of livestock information management – the case of Indo-Swiss project, Andhra Pradesh. *Proceedings of a workshop on Information Systems for livestock research and development in India., 1-3 February, 1993* (eds. Manu, A. and de Groot, B.). Central and Sheep and Wool Research Institute, Avikanagar. pp. 71-78

Maltz, E., Devir, S., Kroll, O., Zur, B., Spahr, S.L. and Shanks. R.D. 1992. Comparative responses of lactating cows to total mixed rations or computerized individual concentrate feeding. *J. Dairy. Sci.* **75**: 1588-1593

Maltz, E., Kroll, O., Spahr, S.L. and Sagi, R. 1991. Milkyield, parity and cow potential as variables for computerized concentrate supplementation strategy. *J. Dairy Sci.* **74**: 2277-2288

Martin, B., Mainland, D.D. and Green, M.A. 1982. VIRUS: A computer program for herd health and productivity. *Vet. Rec.* **110**: 446-448

Maru, A. 1993. Information systems at Central Sheep and Wool Research Institute. *Proceedings of a workshop on Information Systems for livestock research and development in India., 1-3 February, 1993* (eds. Manu, A. and de Groot, B.). Central and Sheep and Wool Research Institute, Avikanagar. pp. 83-90

McGrann, J.W. and Rupp, G.R. 1992. Beef cattle economic decision aid software. *Agri. Pract.* **13**: 15-20

McIlory, S.G., Goodall, E.A., Rainey, J. and McMurray, L.H. 1988. A computerized management and disease retrieval system for profitable broiler production. *Agric. Syst.* **27**: 11-16

McKendrick, I.J., Gettingby, G., Gu, Y., Reid, S.W.Y. and Revie, C.W. 2000. Using a Bayesian belief network to aid differential diagnosis of tropical bovine diseases. *Prev. Vet. Med.* **47**: 141-156

Meek, A.H., Mitchell, W.R., Curtis, R.A. and Cote, J.F. 1975. A proposed information management and disease monitoring system for dairy herds. *Can. Vet. J.* **16**:329-334

Menzies, F.D. 1992. A microcomputer model for predicting output from Deefsuckler herds. *Vet. Rec.* **130**: 9-12

Miller, B. 1981. Computers and herd recording. *In Pract.* **3**(4): 16-19

Mourits, M.C.M., Huirne, R.B.M., Dijkhuizen, A.A., Kerstenen, A.R. and Galigan, D.T. 1999. Economic optimization of dairy heifer management decision. *Agric. Syst.* **61**: 17-31

Mueller, M.1989. Computer aided dairy herd management. *Agri. Pract.* **10**:3-8

Murdick, R.G., Ross, J.E. and Clagget, J.R. 1994 *Information Systems for Modern Management.* Third edition. Prentice-Hall of India, New Delhi, p. 206

Nair, R.C.N. 1994. Computer based information system for animal husbandry sector. *Souvenier 1994,* Kerala Veterinary Surgeons' Service Association, Thiruvananthapuram. pp. 58-60

Noordhuizen, J.P., Buurman, J. and Wilbrink, H. 1986.VAMPP – A computer program for dairy herd health and production control. *Mod. Vet. Pract.* **6**: 308-313

Palazzolo, C. 1996. The human side of computer technology. *J. Am. Vet. Med. Ass.* **208**: 1390-1393

Pandey, A.P. 1997. Farm management. *Handbook of Agricultural Sciences* (eds. Gupta, P. and Gupta, A.K.). Second edition. Kalyani Publishers, New Delhi, pp. 509-536

Pant, K.P. 2001. Goat genetic resources of India and the world. Their production and conservation. *Compendium of lecture notes of Summer school on recent advances in characterization and conservation of animal genetic resources. 10th July-6th August, 2001* (eds. Tantia, M.S., Mishra, B.P., Mukesh, M., Kumar, N. and Kumar, D.). National Bureau of Animal Genetic Resources (ICAR), Karnal, pp. 117-136

Perry, J.T. and Lateer, J.G. 1991. *Understanding Oracle.* BPB Publication, New Delhi, p. 634

Petroutsos, E. 2000. *Database Programming with Visual Basic 6.0.* BPB Publication, New Delhi, p. 859

Pharo, H.J., Sopian, M.J., Kamaruddin, M., Hassan, M.A.A., Cheah, P.F. and Choo, T.W. 1990. Progress in the use of computerized recording systems in dairy cow monitoring and extension in Malaysia. *Trop. Anim. Hlth. Prod.* **22**: 77-88

Pietersma, D., Lacroix, R. and Wade, K.M. 1998. A framework for the development of computerized management and control systems for use in dairy farming. *J. Dairy Sci.* **81**: 2692-2972

Plaizier, J.C.B., King, G.J., Dekkers, J.C.M. and Lissemore, K. 1997. Estimates of economic values of indices for reproductive performance in dairy herds using computer simulation. *J. Dairy Sci.* **80**: 2775-2783

Prasad, J. 2000. *Goat, Sheep and Pig Production and Management*. Second edition. Kalyani publishers, New Delhi. p.365

Putler, D.S. and Zilberman, D. 1988. Computer use in agriculture: Evidence from Tulare country, California. *Am. J. Agric. Eco.* **70**: 790-802

Rahmel, D. 1999. *SAMS Teach Yourself. Database Programming with Visual Basic 6*. Techmedia, New Delhi, p. 381

Reid, S.W.J., Mellor, D.J., Irwin, T., Love, S. and Gettingby, G. 1996. A hypertext knowledge base medium for the delivery of epidemiological models and experts system. *Prev. Vet. Med.* **26**: 97-105

Ringwall, K.A. and Boggs, D.L. 1992. A computer programme for appraising and increasing productivity in beef cattle. *Vet. Med.* **87**: 706-711

Russel, A.M. and Rowlands, G.I. 1983. COSREEL: Computerized recording system for herd health information management. *Vet. Rec.* **112**: 189-192

Sadana, D.K. 1993. Approaches to animal data management at NDRI. *Proceedings of a workshop on Information Systems for livestock research and development in India., 1-3 February, 1993* (eds. Manu, A. and de Groot, B.). Central and Sheep and Wool Research Institute, Avikanagar. pp. 79-82

Sard, D.M. 1981. Computer systems in veterinary medicine. 2. The computer in the practice organization. *Vet. Rec.* **108**:346-348

Sastry, N.S.R., Thomas, C.K. and Singh, R.A. 2000. *Livestock Production Management*. Third edition. Kalyani Publishers, New Delhi. p. 642

Schmisseur, E. and Gamroth, M.J. 1993. DXMAS: An expert system program providing management advice to dairy operators. *J. Dairy. Sci.* **76**: 2039-2049

Schmisseur, E., and Pankratz, J. 1989. XLAYER: An expert system providing management advice to poultry layer managers. *South J. Agric. Econ.* **12**: 183

Schofield, J.L., Calder, J.M., Fraser, I.R., Lewis, M., Oldham, J.D., Offer, N.W. and Rooke, A.J. 1998. FeedByte-Ration formulation and evaluation. *Proceedings of the 7th international conference on computers in agriculture, 26-30th October, 1998.* (eds. Zazueta, F.S. and Xin, J.). American Society of Agricultural Engineer, Mchigan, USA, pp. 903-909

Seegers, H., Malher, X. and Fourichon, C. 1999. Computerised monitoring and decision support to improve reproductive performance of the dairy herd. *Reprod. Domest. Anim.* **34**(3-4): 311-316

Simpson, A. and Robinson, C. 1999. *Access 2000.* BPB Publication, New Delhi, p.1162

Snedecor, G.W. and Cochran, W.G. 1994. Statistical Methods. Eighth edition. Iowa State University Press, Ames, Iowa, p. 564

Sood, S.K. and Kaur, J. 2000. Computer analysis of sequence data. *Indian Dairyman* **52**(2): 5-16

Spahr, S.L., Dill, E.D., Leverich, J.B. and McCoy, G.C. 1993. Dairy-base: An electronic individual animal inventory and herd management system. *J. Dairy Sci.* **76**: 1914-1927

Speicher, J.A. 1981. Computerized data acquisition system for dairy herd management. *J. Anim. Sci.* **53**: 531-541

Spillane, P. 1999.cystitis and endometritis in a 1,000 sow unit. *Pig. J.* **44**: 162-182

Stallings, C.C., Kroll, G., Kelley, J.C. and McGilliard, M.L. 1985. A computer ration evaluation programme for heifers, dry cows and lactating cows. *J. Dairy Sci.* **68**: 1015

Thirunavukkarasu, M. 2000. Prospects for computers in veterinary field. *J. Indian Vet. Ass. Kerala* **5**:55-59

Thrusfield, M.V. 1983a. Application of computer technology to the collection, analysis and use of veterinary data. *Vet. Rec.* **112**: 538-543

Thrusfield, M.V. 1983b. Recording and manipulating clinical data. *J. Small Anim. Pract.* **24**: 703-708

Thrusfield, M.V. 1985. Data recording in general practice. *In Pract.* 7: 128-138

Thrusfield, M.V. and Hinxman, A.I. 1981. A computerized system for storing and querying clinical case record summaries. *J. Small. Anim. Pract.* **22**: 669-679

Tomaszewski, M.A. 1993. Record-keeping systems and control of data flow and information retrieval to manage large high producing herds. *J. Dairy Sci.* **76**: 3188-3194

Trivedi, K.R. and Patel, J.P. 1993. Management information systems developed by NDDB for dairy production. *Proceedings of a workshop on Information Systems for livestock research and development in India., 1-3 February, 1993* (eds. Manu, A. and de Groot, B.). Central and Sheep and Wool Research Institute, Avikanagar. pp. 63-69

Udomprasert, P. and Williamson, N.B. 1990. The DairyCHAMP program: A computerized recording system for dairy herds. *Vet. Rec.* **127**: 256

Voelker, D.E. 1981. Dairy Herd Improvement Association. *J. Dairy. Sci.* **64**: 1269-1277

Vos, M.L., Markers, J.F.S., Bree, D.S. and Verheijden, J.H.M. 1990. TEP – The electronic pig: prototype of a knowledge based computer system for swine herd health. *Prev. Vet. Med.* **9**: 95-106

Wergel, K.A. and Lin, B.W. 2000. Use of computerized mate selection program to control inbreeding of Holstein and Jersey cattle in the next generation. *J. Dairy Sci.* **83**: 822-828

Williams, P.C.W. and Ward, W.R. 1989. Development of a coding system for recording clinical findings in farm animal practice. *Vet. Rec.* **124**: 118-122

Williamson, N.B. and Udomprasert, P. 1989. The DairyCHAMP programme: a microcomputer based health and management programme for dairy herds. *Bovine Practitioner* **24**: 106-109

Winemiller, E., Roff, J., Heyman, B. and Groom, R. 1999. *The Waite Group's, VB6 Database, How-to the Definitive Problem Solver*. Techmedia, New Delhi. p. 1050

# COMPUTERIZED DATA MANAGEMENT SYSTEM FOR GOAT FARM

By

S. RAJENDRAN

## ABSTRACT OF A THESIS

Submitted in partial fulfilment of the requirement for the degree of

# Master of Veterinary Science

Faculty of Veterinary and Animal Sciences
Kerala Agricultural University

Department of Livestock Production Management
COLLEGE OF VETERINARY AND ANIMAL SCIENCES
MANNUTHY, THRISSUR - 680651
KERALA, INDIA

2002

## ABSTRACT

Realizing the undeniable significance of computerization in farming operations and recognizing the potential popularity and growth of goat farming in India, every attempt has to be made to introduce computerized management into goat farming. The present study was carried out in Kerala Agricultural University sheep and goat farm to introduce computerized data management system. The study involved the evaluation of the existing system, identification of the input requirement for developing computer program, development of computerized data management system (CDMS) evaluation of the CDMS, and comparison of the existing system with CDMS.

Average time required for entering a set of data in livestock, birth, medicine stock, miscellaneous articles, stock, feed, milk recording and disposal, disposal and mortality and breeding registers in the existing system were found to be 21.36 ± 1.13, 34.58 ± 0.81, 30.86 ± 1.13, 32.06 ± 1.01, 32.94 ±1 .07, 18.39 ± 1.08, 31.47 ± 1.21 and 15.28 ± 1.03 seconds respectively. Average time required for recording a set of entries in kidding, mortality, sale of animals, breeding and milking events were found to be 47.47 ± 1.52, 67.83 ± 1.69, 57.36 ± 1.48, 15.28 ± 1.03 and 18.39 ± 1.08 seconds respectively in the existing system. Time taken to get data on population status, feed ingredients, total quantity of feed fed to animals, number of animal bred, kidding, total milk

production, milk disposal, mortality and sale, transfer, and culling in the existing system was calculated.

Input requirements were determined based upon the data to be stored and the data to be obtained from the proposed computerized data management system (CDMS). Based on the information collected and anticipated reports required for an efficient goat farm management, a combination of Visual Basic 6.0 as front end tool and Microsoft Access 97 as back end tool were used. Computerised data management system for goat farms is structured under a main menu with various menus such as status, feed, production, reproduction, health, view reminder, reports and exit.

The status menu under the main menu allows the user to record and retrieve various categories of animals. It is further divided into kids, young stock, adult stock, total stock, daily stock, medicine stock and miscellaneous article stock options. The feed menus has feeds and feed requirement submenus. Feeds sub menu allows the user to record purchase and issue details of feeds and feed requirement submenu gives details about nutritional requirement of various categories of animals.

The production submenu is divided into weighing, growth chart, milk recording, milk chart and weaning for recording weighing measurement, calculating average daily weight gain, growth trend of an animal, milk yield, milk production trend of an animal and weaning details respectively.

Reproductive menu is segmented into oestrous, service and kidding. Date of heat and expected date of next heat can be recorded and obtained from oestrous option. Service option allows the user to get details about date of service, pregnancy diagnosis and expected date of kidding. Kidding details can be stored in the kidding option. Kidding interval, parity details and dry off date can be obtained from this submenu.

Reminder menu is designed to obtain the checklists of animals due for vaccination, treatment, deworming, dipping, heat, service, kidding, weaning and dry off. View menu can display all the recorded information under various tables. Report menu is designed for obtaining animal strength, disposal details, feed details, production and reproduction performance, service report, breeding efficiency and farm income.

Average time requirement to enter a set of entries in kids, medicine stock, miscellaneous articles, feed, milk recording, service, milk disposal, mortality and sales, transfer and culling records in the computerized data management system were 19.17 ± 0.81, 20.75 ± 0.69, 21.81 ± 0.71, 26.19 ± 0.79, 11.67 ± 0.84, 22.67 ± 0.99, 24.00 ± 0.68, 25.64 ± 0.08 and 27.50 ± 0.61 seconds respectively. Average time required for recording a set of entries in kidding, mortality, sale of animals, breeding and milking events were found to be 44.08 ± 0.94, 25.64 ± 0.80, 27.50 ± 0.61, 22.67 ± 0.99 and 32.92 ± 1.38 seconds respectively in the computerized data management system. Time taken to get data on population status, feed ingredients, total quantity of feed, number

of animals bred, kidding, total milk production milk disposal, mortality and sales, transfer and culling was calculated.

Average time required for entering a set of entries in the computerized data management system was significantly ($P<0.01$) less than that of the existing system except breeding register which required more time in the computerized data management system than existing system. Average time required to record a set of entries in each event in the existing system was significantly differed ($P<0.01$) from that of CDMS). The present study revealed that there was a significant difference ($P<0.01$) between the existing and computerized data management system in case of time required to retrieve data.