EFFECT OF HERD HEALTH PROGRAMME ON PERFORMANCE IN SOME ZEBU CATTLE HERDS IN BAUCHI STATE

BY

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AUGUST, 1998.

DECLARATION

I hereby declare that this dissertation was written by me and it is a record of my own work. It has not been presented before in any previous application for a Doctor of Philosophy degree. References made to published literature have been duly acknowledged.

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CERTIFICATION

This dissertation entitled **"Effect of a herd health programme on performance in some Zebu cattle herds in Bauchi** state submitted by **Ayuba Caleb Kudi,** meets the regulation governing the award of the degree of Doctor of Philosophy, Ahmadu Bello University,Zaria.

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This project is dedicated to my darling wife and beloved son, Mrs Mary Caleb Kudi and Master Haruna Aaron Kudi for their patience during the course of the study and for their constant love and encouragement.

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ABSTRACT

A herd health and production programme was designed for 16 zebu cattle herds in Bauchi State. Planned monthly visits were made to each herd; additional visits were made only on the request of the herd owners. At the beginning of the study, each animal was identified, herd structure determined for each herd full physical examination conducted for each animal in the herd. During each monthly visit, blood and faecal samples were taken and examined for haemoparasites and gastrointestinal parasites respectively and presence of tick infestation recorded. Herds were vaccinated at the beginning of the study and yearly, against rinderpest, contagious bovine pleuropneumonia (CBPP) and black quarter. All herds were also screened for tuberculosis using the single cervical comparative test and for brucellosis using the serum agglutination test, at the beginning and at the end of the study. Rectal examination was done on each visit to check for pregnancy and / or ovarian activity. Advice on management and intenventions were given to each herd owner. Also some medicinal plants used by the Fulani herds men were collected during the visits to the herds, identified and screened in-vitro for antiviral and antibacterial activity. Data collected were subjected to Chi-square test, Cow-Months, Ratio-to-Moving Average method, Life-Table method, Seasonal Index and simple percentages.

The herds had 2 management systems; extensive and semi-intensive systems. The semi-intensive herds grazed natural pasture with little supplementation while the extensive grazed only natural pasture. Seven herds were managed by illiterate staff. There was on the average one bull to 2 'cows in most herds and attempt to introduce control mating and culling of mature bulls to the desired cow:bull ratio were rejected by most of the

herd owners.

The result showed that the prevalence of tuberculosis and brucellosis decreased in some herds or were eliminated in most herds. Parasitic diseases were found to be prevalent during the rainy season (June to September). Infection and infestation decreased yearly in all the herds. Other diseases encountered were CBPP, dermatophilosis, foot-and-mouth disease, pneumonia, coccidiosis, gastroenteritis, poisoning and septicemia. Calf mortality and morbidity rates were high in all herds in the first year but greatly reduced in the second and third years of the study. Also, survival of calves within the first 12 months of life increased in the second and third years of the study from 44.7% to 54.6% for the second and 62.5% for the third year respectively. This was found to be due to the interventions instituted.. Monthly mortality rates showed that most deaths occurred during the rainy season and during the period of feed scarcity. Of all the cattle culled, tuberculosis and brucellosis accounted for 11.9%, chronic dermatophilosis 64.9%, old age 16.2%, malnutrition 5.4% and reproductive failures 1.6%. Cause associated case-fatality rates for adult cattle showed that of all the cases of; poisoning (mainly plant poisoning) 18.8% died, Foot-and-mouth disease 14.3% died, coccidiosis 12.5% died and CBPP 11.1% died while of all the cases of infection in calves, 50% died due septicemia, 23% died due to calf scour, 28% died due to gastroenteritis, 35.3% died due to coccidiosis and died 27.4% due to pneumonia.

Age at first calving for cows was between 4 and 5 years after birth. The total number of animals pregnant and the outcome of pregnancy showed that more cows calved and the frequencies of abortion and stillbirths decreased as the study progressed till the third year. The calving interval in all herds was found to be more than a year and varies from herd to herd depending

on the management. Of the 13 crude extract of medicinal plants tried, six (6) namely *Khanya senegalensis, Dichrostachys glomerata, Boswelia dalzelli, Xylopia aethiopica, Butryspernum parkii* and *Hyptis pectinata* were found to have broad spectrum antiviral and antibacterial activity.

The study was able to show that a herd health and production programme is practicable in Nigeria and could be undertaken to improve productivity. This study also identified the constraints to developing a herd health and production programme which included unco-operative attitudes of the farmers, poor management practices, inadequate feeds, diseases, lack of records and input factors. These constraints could be overcome if the farmers are educated on the effect of subclinical diseases on production and the role of herd health and production programme in improving productivity.

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CHAPTER 1

1.0 INTRODUCTION:

A herd health planning can be defined as a planned and co-ordinated approach to achieving and maintaining optimal health and productive efficiency of livestock; optimal being defined in relation to the objective of the herd owner (Blood et al.,1978). In general, it can be taken that the objective of the farmer is to maximize the net return from his livestock enterprise and to reduce fluctuations in income between years. In the health programme, the aim is to modify the disease status of the animals in the farm and influence their management so that reduction in the net farm income caused by disease is minimized (Schnurrenberger,1979). This type of programme involves a scheduled veterinary activities and good herd management designed to achieve and maintain optimum animal health and production (Blaxter,1979; Blood,1979). The programmes vary from simple systems, in which the veterinarian visits the herd on a regular basis to examine animals and their performance and to make recommendations for the control of disease and improvement of production, to intensive programmes, in which the veterinarian, with the assistance of other animal specialists, makes detailed recommendations about the daily management of the animal health/ production program. These may include

recommendations on nutrition, control of diseases, genetic improvement, purchase of breeding stock, housing and culling of unproductive animals (Blood *ef al.*, 1978).

Disease in livestock has always been a problem of considerable importance to farmers. It is now generally agreed upon that sub clinical diseases or production inefficiencies, many of which cause no recognizable clinicall signs, are the most important contributors to reduced productivity. That is why the assistance of the veterinarian and other agricultural specialists who can provide knowledge, skills and other resources is being sought in the developed countries. Such services have always aimed at improving the health and production efficiency of livestock by preventive procedures. There has been gradual evolution of approach in achieving this aim as particular dominant problems have been solved, and new priorities have emerged (Morris et al, 1978). Thus, in such developed countries, the emphasis has shifted from individual animals affected by clinically recognizable diseases to those diseases which manifest themselves principally through impairment of productive efficiency without producing obvious clinical signs (Blood *et al.*, 1978).

Traditionally, in Sub-Saharan Africa, the veterinarian was always called

upon to work with livestock only when a valuable animal was about to die or as a coincidental adjunct to some routine vaccinations. The expectation was for him to make a diagnosis and recommend a treatment or vaccination program, hopefully using some new "wonder" drug that was specific for the animal's unique problem. The result of such consultations and treatments have seldom been gratifying; thus solutions to health problems are sought first in bottles and boluses. Only after such an approach has repeatedly failed does one really become convinced that husbandry practices need to be pursued to control livestock health (Putts *et al.*, 1988). Unfortunately, in Nigeria, the situation has not changed as compared to other countries in the Sub-Saharan Africa like Botswana, Chad and Mali, where livestock is a major force in their economy. In many areas of these countries, livestock is one of the most important sources of employment and cash income, which can be used to purchase inputs for crop production and provides an outlet for surplus grain. Thus, it is safe to assume that Nigerian agriculture needs a healthy livestock industry to achieve optimum growth. Unfortunately, livestock diseases stand in the way of such growth at present (Nuru,1975; Alhaji, 1976; Fabiyi , 1984; Ajayi , 1995; Mohammed, 1984.). Handling such diseases is also difficult because most of the livestock are in small scale family units. In such units, the occasional animal that falls sick either gets better or dies.

Faults of feeding, breeding, housing and day to day management are all implicated in the presence of apparent disease. This is particularly true in large intensive government farms where one of the compelling reasons for adopting a controlled environment is the elimination of the ills and poor performance that plagued extensively kept animals. Until recently, animal disease control in Nigeria and Africa, at large, was almost exclusively the responsibility of the public sector. However, in the past few decades, the quality of its veterinary services has deteriorated. Operational problems have contributed significantly to this decline. In many cases, veterinary staff expanded much faster than the means of support, while escalating operating cost made it necessary to cut back on field services. This forced the agropastoralists to revert to traditional method of handling livestock diseases (Gefu and Otchere, 1994).

In Nigeria, livestock ownership has become more diversified. Crop farmers, government officials and traders see livestock as one of the profitable investment opportunities available. These new livestock owners recognized the importance of disease control in reducing the risk to their investment. However, they have no experience in livestock raising and therefore depend much more on outside assistance for veterinary care than

traditional pastoralists do.

Most losses in productivity of grazing animals are associated with herd or flock health rather than with clinically apparent disease. Therefore the prevention and treatment of such diseases involve measures applied to the whole herd. Thus, parasitic diseases, nutritional and metabolic diseases and widespread chronic infectious diseases such as tuberculosis, brucellosis, dermatophilosis and mastitis, not only require herd treatments, but their control/prevention needs to be integrated with the grazing management of pastures and with the known epidemiology of pathogens. It is with the above stated problems in mind and due to the fact that many livestock improvement programs have failed, because livestock were not dealt with as groups and also because of the presence of epizootic diseases that this study was designed with the following objectives:

1. To study the present situation of livestock production with a view to identifying the problems through the determination of morbidity and mortality and management problems in selected farms.

2. To study, in relation to production, the prevalent diseases particularly:

a) Tuberculosis.

b) Brucellosis.

c) Dermatophilosis

d) Parasitic diseases

3. To study the reproductive status of the herds.

4.To study the traditional method of treating livestock diseases.

5. To study the effect of interventions in reducing the risk factors to production and thus improving herd performance.

CHAPTER 2

2.0 LITERATURE REVIEW:

2.1 GENERAL PRINCIPLES OF HERD HEALTH PROGRAMME:

Food producing animals make important contributions to agriculture and human well-being. One of the most important needs of humans is a dependable food supply (International Livestock Center for Africa (ILCA) Manual, 1990). The efficient production of livestock that yields meat, milk and fibre is a major concern of society in general and of sociologist, animal scientists and animal specialists in particular. One of the important functions of domestic farm animals is the conversion of human edible forages, by-products and crop residues into high quality human food in the form of meat, milk and eggs (Bradford, 1989).

In developed countries, livestock have an important buffering effect on cereal grain prices and food supplies. For example, in America, the beef feedlot industry responded to the availability of inexpensive grains because of the large increase in yields per acre which is associated with the adoption of new technologies for grain production (Bradford, 1989). In developing countries most animal production utilizes no human edible inputs. The

improvement in quality and nutrient balance of human diets from the inclusion of animal products is particularly important where protein quality and quantity tend to be limiting (Bogoro *et al.*, 1994).

In developing countries, where feed grains are in short supply, an increase in the use of small ruminants, such as sheep and goats, which can convert a wide variety of plant products into human food energy and protein, is a major development. Another important contribution of animals in developing countries is their buffering effect on food supply and income. Herds are built up during good seasons and years and slaughtered for food during periods of drought. In some countries, especially where credit and banking services are not available, livestock are used for their monetary value and can be sold more readily in times of need than most other commodities produced on the farm (Bradford, 1989).

Animals also provided 75-90% of draft power for agriculture and transport in large regions of the world countries (Blood & Radostits, 1985; Gefu and Otchere, 1994). Because many countries lack the capital required to purchase the mechanical tractor power and fuel needed for modern mechanized agriculture, animal draft power is likely to remain an essential component of agriculture in many countries for a long time (Bogoro *et al.*,

1994). Farm livestock also provide fertilizer in the form of manure, which may become more important in efforts to sustain soil fertility in areas that have experienced excessive erosions because of continuous tilling and cropping (Bradford, 1989).

In addition to the important biologic functions performed by livestock in agricultural systems in developing countries, animals often have significant social and cultural value. For example, the slaughter of rams for religious festival of Islam and the status of Fulanis in west Africa which is based on the total number of cattle owned (Bradford, 1989; Gefu, 1987).

However, disease in farm animals has always been a problem of considerable importance to farmers. Good livestock husbandry equates with looking after animals properly and maintaining them in good health in order to obtain optimum production of their products. With intensification of production methods, the health status of animals becomes increasingly a primary determinant of productivity on livestock farms. In such instances, the assistance of the veterinarian and of other agricultural specialist who can provide knowledge, skills and other resources is sought (Blood, 1979).

Therefore, a planned animal health and production management

programme is required to solve the above stated problems and it involves a combination of regularly scheduled veterinary activities and good herd management designed to achieve and maintain optimum animal health and production (Blood and Radostits, 1989).

The primary objective of a herd health and production management programme for herds of food producing animals is to maintain animal health and production at the most efficient level that provides maximum economic returns to the animal owner (Schnurrenberger, 1979). The ever-present goal is to control and manage animal health and production at a high level of efficiency, while at the same time seeking and introducing new techniques that can continue to improve efficiency (Blaxter, 1979).

2.1.1 Factors Affecting The Development Of Herd Health Programme:

Several factors have slowed down progress toward the widespread adoption of effective health and production management techniques by producers and have retarded the delivery and marketing of those techniques by veterinarians to producers. Many producers are familiar with the economic consequences of clinical disease in animals but do not fully appreciate the existence of subclinical diseases (BVA Trust Project, 1982).

Often, they do not recognize that subclinical diseases can impair productivity and on a herd basis can be a greater source of economic loss than clinical disease. They are also not fully aware of the economic returns that are possible by monitoring animal health and production accurately on a herd basis and by taking positive action to improve performance of the herd (Ngategize *et al.*, 1986).

Traditionally, producers in the developed world were willing to pay for emergency veterinary services on individual clinically ill animal. However, now many producers and farm managers are still reluctant to pay for veterinary advice on health management and production when results are not immediately obvious. Many farmers in developed and indeed developing countries perceive veterinarians only as primary providers of clinical services (Goodger and Ruppanner, 1982b). Many large farms require an integrated approach to herd management but the operators have not looked to veterinarians for such comprehensive production-oriented management advice. Instead, they have employed the services of agribusiness industry, representatives including graduate agronomists, animal nutritionists, agricultural engineers, accountants and other professional agriculturalists, for advice on management and production, with emphasis on economics and how to reduce the cost of production (Curtis, 1991).

It has been suggested that in the developed world, there is a shortage of food animal practitioners who can provide profitable veterinary services to primary livestock producers. In developing countries, it is almost non-existent. It is thought that these shortages may continue because of the shortage of adequately prepared graduates (Blood and Radostits, 1985).

Food animal practitioners need to be more knowledgeable in the areas of health information and farm management, and must be effective communicators and good problem solvers. If they do not have these skills, herd health programmes cannot be developed. Veterinarians generally have few conflicts with no vested interest, when giving advice about nutrition, proper facility design and general management issues. Thus, this perception of the veterinarian as a clinician only deprives the intensive farmers of an objective, integrated appraisal of herd health, management and production. Changing this perception must start from the veterinary schools by restructuring of the curricula. The emphasis needs to be on courses in clinical epidemiology, health management on herd basis, nutrition and veterinary economics (Pritchard, 1989).

The perception by the producers that veterinarians are not production-oriented has been one of the constraints of more widespread employment

of veterinarians as health management advisors. The goal and values of producers have also been responsible for some of the slow growth of herd health (Gasson, 1973). An analysis of the goals and values of a cross section of British farmers revealed that the smaller farmers place more stress on intrinsic aspects of work, particularly independence. Farmers with larger businesses, however, are more economically motivated and are more likely to seek and consider consultants advice about health and production management (Winkler, 1979).

The personal characteristic of producers also influence livestock performance (Tarabla and Dodd, 1990). Some producers follow certain recommendations regarding disease control that seem to be ignored by others, yet others do not keep records or if they do keep them may not use them. Interaction among attitudes and management practices suggests that attitudes act as effect modifiers on the relationship of management practices to herd performance (Bigrass-Poulin et al., 1984a,b). This suggests that attitudes should be measured and considered before proposing management practices to improve performance. This is a major factor affecting the development and success of herd health programmes especially in developing countries (Jawara, 1990).

Another important factor affecting the rate of development and the success of herd health programmes has been the lack of reliable health management records that can be analyzed regularly. The success of a herd health programme depends upon the competence and enthusiasm of the veterinarian, the management expertise of the producer and the ability of the programme to demonstrate progress through improved performance. Only the records can help to document improved cost effective performance. When reliable records are lacking or cannot be easily analyzed, the veterinarian cannot demonstrate to the producer that progress has been made. With no clear evidence of progress, the producer may become disinterested in the programme (Cannon *et al.*, 1978).

The economic value of the animal can influence the development of herd health. As the value increases, the need to reduce the risk of loss of the individual or its productive capacity increases. As the value of food-producing animals continues to increase, the need for diagnosis and treatment of individual sick animals increases. The emphasis is on nutrition and reproductive performance. Disease control strategies such as those for internal and external parasites are developed. The risk of disease losses and the need for veterinary supervision are even greater in the large, factory-type farming units that are common in most developed countries

(Watson, 1980).

As long as veterinarians are making a good living from emergency veterinary medicine and prescribing and dispensing animal health supplies, there is little incentive to develop herd health programmes. The fact that emergency work is satisfying to some veterinarians and producers has further slowed progress. Some veterinarians also lack the confidence necessary to provide a comprehensive animal health service that includes investigation of the nutritional status of the herd, housing requirements, reproductive performance and other reproduction-oriented aspects of the herd (Goodger and Ruppanner, 1982a).

Other factors that can affect planned health management programmes include the availability of feed supplies, the market value of livestock, the prevalence of disease in the herd and the diagnostic laboratory services available to the veterinarian. Large fluctuation in the supply of feed can cause major disruptions in performance. A marked decline in the market price of livestock can force farmers to invest scarce resources elsewhere on the farm. A sudden unexpected epidemic of an infectious disease can cause large economic losses, and the farmer may lose confidence in the veterinarian's ability to control disease (Blood and Radostits, 1985).

2.1.2 Requirement Of A Herd Health Programme:

The three requirements for a successful herd health programme are a progressive livestock producer, an enthusiastic competent veterinarian and an animal health and production data and information system. An even more fundamental requirement before a programme is begun is the establishment or growth of a satisfactory veterinarian-producer(client) relationship (Blood and Radostits, 1985).

2.1.2.1 Progressive Livestock Producer;

The success of a herd health programme depends on the quality of a producer's management skills, including the desire and the ability to comply with the recommendations of the veterinarian and other agricultural advisors involved (Blood and Radostits, 1985). Characteristics and attitudes that are desirable for a producer to adapt a successful health management programme that can set an example for the rest of the community as described by Huffman (1979) are as follows:

i) Leaders in the community :- These are the progressive producers whose opinion are valued by other producers.

ii) Successful business people:- Business acumen is a highly desirable characteristic, especially if the producer has a good farm that is the primary source of income. These producers are aware of the principle of cost effectiveness and opportunity cost, and net profit from the farm is a primary objective.

iii) Information-oriented people:- They recognize the need to keep and use animal health and production records.

iv) Knowledgeable Producers:- These are producers who keep up to date with the farm literature and are interested in learning more about the modern aspects of animal health and production. They recognize the interactions among reproduction, nutrition, mastitis, milk production and calf health management. Also they appreciate the contributions that veterinarians can make in addition to their traditional role in emergency medicine (Cann, 1980; Antle and Goodger, 1988).

To develop a situation in which producers are committed to a herd health program requires two stages. The first is to convince them to begin by establishing a bond of confidence between the producer and the veterinarian by determining that there is a problem in the herd that is likely to be responsive to a cost-effective control programme, and if necessary, by beginning the programme on a partial basis. It must be noted that the

producer's goal and objectives must be taken into consideration (Huffman, 1979). Having established a programme in a herd, the challenge for the veterinarians is to maintain it.

2.1.2.2 Veterinarian Enthusiasm And Competence;

A successful health and production management programme depends heavily on the enthusiasm and competence of the veterinarian providing the services. Most veterinarians who are active in health management programmes began their careers in large animal practices, which provided primarily emergency veterinary services on an individual animal basis. As they develop sufficient experience and confidence with their clinical skills, they directed their interest towards health management of the herd or flock (Blood *et al.*, 1978).

Veterinarians can provide producers and managers with information and advice on all aspects of the livestock components that influence health, productivity and profitability (Nordlund, 1989). Livestock producers are seeking information from veterinarians on how to manage their individual enterprises and maximize profitability. They are interested in specific information on nutrition, housing, genetics, drug therapy, vaccination, use

of oestrus synchronization techniques and sanitation procedures to mention but a few examples (Tarabla and Dodd, 1990). Most producers now need the assistance of unbiased experts, like veterinary species specialists, to use the highly technical information that is available in order to make traditional management decisions (Bradford, 1989). Producers turn to veterinarians to relate the vast amount of information to their particular enterprise. This means that these veterinarians need good verbal and written communication skills which can be acquired with practice. It means large amounts of time analyzing records and writing concise reports, which are sent to the producer (Thrushfield, 1988).

Veterinarians who provide these services have to become knowledgeable about a species or class of livestock and about the economics of production, clinical epidemiology, nutrition, housing and environmental management, reproductive performance, control of infectious diseases and marketing aspects of the industry with which they work (Pritchard, 1989). They should be committed to the role of the veterinarian in production-oriented veterinary medicine as species specialists (Blood, 1979; Radostits, 1989). The need to provide a broadly based, totally integrated planned animal health and production management veterinary services should be a high priority for them and their practice.

Clinical epidemiology is an integral part of health and production management and will become an important part of the education and skill of veterinarians in food animal practice (Martin and Bonnett, 1987). New approaches to animal health problems include more observational studies, which interact with the disciplines of sociology, economics and mathematical analysis (Davies, 1985). In the past, in the developed world, the lacking of herd level expertise contributed in part to the lack of demand for veterinary services by livestock producers (McDermott *et al.*, 1987). Veterinary graduates were educated to deal with the individual animal, but were not prepared to solve herd level problems. As a result, many herd health recommendations were based on extrapolation from traditional individual-animal medicine. A major challenge for the veterinary profession is establishing expertise in herd-level decision making based on appropriate comparisons of herd-level treatments among sufficient numbers of farms (McDermott *et al.*, 1987).

2.1.2.3 Animal Health And Production Data;

One of the most successful herd health programme is keeping good records that can be used to monitor animal health events, level of production and the incidence of disease (Blood *et al.*, 1978). A simple,

reliable system of recording animal health events and production performance is a fundamental requirement for a successful herd health programme (Cannon *et al.*, 1978). Without records, the analysis of productivity involves guess work and the recommendations for improvement cannot be made with confidence. The records systems involves all components, from the records containing raw data to the summaries of animal health and performance (Russels and Rowlands, 1983). Many different systems are available but the fundamental requirements are :

_ Positive identification of the individual animal.

_ The system must be simple to use and understand.

_ Only animal health and production data that are considered necessary to assess herd-performance are monitored and analyzed.

_ Systems must be structured so that the data are easily collected, gathered, analysed, summarized and available to the producer (Janzen, 1983; Church, 1980).

2.1.3 The Components Of A Herd Health Programme:

The components of a herd health programme include regularly

scheduled farm visits by the veterinarian, good farm management by the producer, the recording and analysis of animal health and production data, and the provision and co-ordination of advice by the veterinarian (Blood *et al*., 1978). The success of the programme depends on the competence of the veterinarian, the level of management of the producer, the reliability and adequacy of the records and the competence with which the veterinarian provides advice and follows up the results of that advice (Bigrass-Poulin *et al*., 1984b). A major determinant is the extent to which the producer complies with the advice of the veterinarian and adopts the recommendations of the veterinarian (Bigrass-Poulin *et al*., 1984b).

The veterinarian should identify the objectives of the producer before beginning a program. A clear picture of the production objectives, compared with actual performance, often identifies the presence of problems that have interfered with performance (Blood *et al*., 1978). The initial stages of any programme should concentrate on solving obvious disease or production problems for which there are some obvious and reliable solutions. When these problems are resolved, attention can then be given to evaluating health and reproductive status of the herd and to the identification of other economically significant problems (Blood and Radostits, 1985).

2.1.3.1 Visit To The Herds;

The most common aspects of any herd health programme is the regularly scheduled visit to the herd. The frequency of visit depends on the class of livestock, the size of the herd, the prevalence of disease, the existence of particular disease problems, the level of risk aversion of the producer and the length of time the herd has been on a programme. Monthly visits are common but weekly visits become necessary if dealing with exceptionally large herds (Blood and Radostits, 1985).

The traditional practice of regularly scheduled visits to the herd is probably becoming inadequate for some herds. It is now obvious that once a veterinarian becomes involved with the health management of a herd, it may be necessary to visit the herd as often as required to initiate and complete certain strategies and tasks (Blood and Radostits, 1985). This means that veterinarians should divert the animal health and production management programme and visit the farm as often as necessary to achieve the level of animal health and production desired (Kearley, 1989).

2.1.3.2 Activities During The Farm Visits;

There are several animal health and production activities that occur during the production cycle of each animal. A major objective of the visit is to determine the actual performance of the animal health and production, compare it with targets of performance and farm goals, and decide which performance index is abnormal; then an attempt is made to determine the cause(s) of the shortfall in health status or production and to formulate cost-effective correction action (Tarabla and Dodd, 1990). The regularly scheduled farm visit is also part of a surveillance system design to detect or predict animal health and production problems before they become economically significant, and to indicate the corrective action necessary (Blood and Radostits, 1985).

Some examples of specific farm visit activities are:

2.1.3.2.1 Reproductive Performance;

In breeding herds, a major emphasis is on surveillance of reproductive performance (Blood *et al.*, 1978). For example, in dairy herds, which calve year round, at each monthly visit all cows bred more than 40 days earlier

are examined for pregnancy by rectal palpation (Brith *et al.*, 1981). The cows to be examined are identified by review of the individual cow records for calving intervals, age at first calving, pregnancy and ovarian activity. Regular pregnancy examinations can identify non-pregnant cows as soon as possible so that early intervention can be taken (Galton *et al.*, 1977). In beef breeding herds, the bulls are examined for breeding soundness before the breeding seasons begins. Pregnancy diagnosis and examination are done only annually, preferably in early pregnancy. This is possible especially for artificially inseminated cows (Blood and Radostits, 1985).

2.1.3.2.2 Production Performance;

The production performance of livestock and their productions can be monitored on a continuous basis and the data used as indicator of performance (Remillard and Thatcher, 1988). The parameters include average daily milk production, butterfat test, average daily body weight gain and calving rates amongst others.

2.1.3.2.3 Nutritional Status;

The feeds and feeding program have a major influence in reproductive

performance, growth rate and milk production, and must be monitored regularly (Bigrass-Poulin *et al.*, 1990a,b). The veterinarian must be aware of any changes in the feeding programme that have occurred since the last farm visit or that are intended in the near future. On breeding farm, there are several different age groups of animals at different levels of growth and production. This requires close surveillance to avoid under nutrition or over nutrition (Remillard and Tharcher, 1986). An experienced and competent nutritionist should be consulted to assist with complex nutritional problems (Remillard and Tharcher, 1988).

2.1.3.2.4 Clinical Examination Of Animals;

On a herd basis, there are usually some animals affected with disease that the farmer has identified. They should be examined and the necessary laboratory samples taken to obtain a definitive, causative diagnosis (BVA Trust Project, 1982).

2.1.3.2.5 Disease Occurrence;

The records of all clinical diseases that have occurred since the last visit should be examined. The diagnosis, course of the disease, morbidity and

case-fatality rates, treatments used and response rates should be determined (Blood and Radostits, 1985). If possible veterinarians should attempt to determine the cause or risk factors retrospectively from the evidence available and to prescribe advice on the treatment and control of future cases (Janzen, 1983).

2.1.3.2.6 Provision Of Drugs And Vaccines;

Drugs and vaccines to be used in the herd are commonly supplied by the veterinary practice. Some practices supply the products at a reduced gross margin of profit as part of the health management programme. The veterinarian must certify the drugs as genuine and must be aware of the drugs and vaccines being used in the herd (McInerney, 1988).

2.1.3.2.7 Environmental Management;

In areas where animals are housed indoors or kept confined outside, the management of the environment is a major determinant of health or disease (Wesbter, 1981). Much is known about how environmental variables affect productivity of domestic animals. These include:

i) the adequacy of the ventilation of housed animals.

ii) the daily fluctuation in temperature and relative humidity inside barns.

iii) the quality of air and the concentration of gases such as ammonia, hydrogen sulphide, carbon dioxide and methane.

iv) the comfort of the housing.

v) the quality of the floor.

vi) manure disposal system, and

vii) population density of the animals (Blood and Radostits, 1985).

The methods of feeding and amount of dust, created by feeding systems may have an important influence on respiratory diseases (Martin *et al.*, 1987). The method of cleaning and disinfecting used in critical areas such as milking parlour can contribute to the outbreak of diseases (Bigrass-Poulin *et al.*, 1984b). Lameness caused by diseases of the feet is a major problem associated with floor quality and ground surfaces in dairy cattle confined indoors or in zero grazing systems (Brith *et al.*, 1981).

2.1.4 Cost And Benefits Of A Herd Health Programme:

Health management veterinary services have many inherent costs. These include professional services on the farm, travel, drugs, vaccine and

other animal health supplies. There is little documented information on the total input costs of all veterinary services and supplies for the health management of herds of food producing animal herds. The amount of money spent on animal health services and supplies as a part of the total costs of production is low compared with other costs (Howe, 1988; New, 1991) . However, benefits associated with herd health management programmes are social, economic and managerial.

2.1.4.1 Social Benefits;

The benefits of animal health management programmes accrue to society as a whole. Apart from the fact that the production of wholesome human food is a major objective of livestock industries, the Fulanis and most cattle owners see it as a symbol of achievement or greatness especially with regards to social status (Gefu, 1992). Also disease in farm livestock has always been a problem of considerable importance to producers. Because some diseases are infectious and can spread from farm to farm, and because zoonoses can adversely affect the human population, society also benefits from effective animal health management programmes. Disease control programmes benefit society by improving the quality and hygiene of food, public health, the increased awareness of welfare of animals

(Grossklaus, 1987).

2.1.4.2 Economic benefits;

Enhancement of the profitability of the producer must be a primary objective of a health management programmes (Blood and Radostits, 1985). The increased interest in applying economic principles to the analysis of veterinary services is an important step toward meeting this objective (Lloyd *et al.*, 1987). The veterinary costs of a herd health programme are part of the variable or optional costs of farming, such as those associated with feed, fertiliser, supplies and services. Based on cost-benefit analysis techniques, the net return to the producer of money spent on veterinary services directed towards a comprehensive herd health programme has been calculated for some specific disease control techniques such as control of mastitis and improved reproductive performance in dairy herds. The net returns have been on the order of 200-500% (Ellis and James, 1979).

It is generally stated that production management and veterinary services increase net profit to the producer and to the veterinarian and provide wholesome food to the consumer at a reasonable price (Ferry,

1992). Most of the documented evidence has been generated from dairy herd health programmes, in which comparisons in performance were made on dairy farms before and after a herd health programme was conducted for up to 3 years (Jointex, 1976; Sol, 1982). There is also some indication that, as the level of performance improves, health costs decrease (Shanks *et al.*, 1982).

2.1.4.3 Aids To Management;

An established operative herd health programme with a reliable record system automatically results in the development of several useful aids to management (Howe, 1988). One example is the development of action lists, which assist the producer in identifying when certain events occur or in determining which action must be taken with particular animal. These animals are highlighted by the records system which prompts the producer to perform the action when necessary. Some examples in a dairy herd include the identification of cows for reproductive tract examination, the use of prostaglandins in postpartum dairy cows, cows to be dried off, cows due to calve, cows to be culled, an improved heat detection system using heat detection aids, cows for mastitis examination and regular use of diagnostic tests, and cows to be examined because of a history of clinical disease

(Blood, 1979). Other aids to management include predictions of calving pattern, regular assessment of nutritional status of the animal and feed requirements and cash flow.

The central theme is that a health management programme involves a system that alerts the producer automatically to pay more attention to the various points in the production cycle at which certain producers need changes to be done and when (Cannon *et al.*, 1978).

2.2 CONTROL OF INFECTIOUS DISEASES OF FOOD PRODUCING ANIMALS:

2.2.1 Magnitude Of The Problem;

A large number of infectious diseases affect food-producing animals and their control must be considered in any animal health management programme. Infectious diseases are important for a number of reasons and include loss of productivity, epidemics of diseases, diagnosis and principles of control (Bendixen, 1988).

2.2.1.1 Loss Of Productivity;

Infectious disease can be a major cause of economic loss and can cause considerable suffering and pain (Briggs, 1985). Example of such disease include pneumonia, foot-rot, foot-and-mouth disease, ectoparasite and parasitic gastro-enteritis, dermatophilosis and brucellosis. These diseases have been and are still known to be a major cause of economic losses in livestock in the tropical world and Nigeria in particular (Pullan, 1979; Nuru and Dennis, 1976; Bida, 1973; Ogunsusi, 1985; Maina, 1986).

Brucellosis and tuberculosis, even though eradicated in some countries of the world, are still a problem in Nigeria and are difficult to control thereby resulting in large economic losses. Infectious diseases of the respiratory and digestive tracts and the mammary system are endemic on most livestock farms and account for a large portion of the veterinary activity involved in disease control (Ajayi, 1995). Most of the losses are in milk production, calf mortality, long calving, anaestrus, abortions, stillbirths, loss of weight and many more (Magaji, 1984).

2.2.1.2 Epidemic Of Disease;

Epidemics of infectious disease in food-producing animals seem to be occurring with increasing frequency in recent years (Voh jr. *et al.*, 1993).

These epidemics may be associated with the intensification of livestock production and a greater opportunity for the spread of infectious agents from infected to susceptible host, management and control policies (Bendixen, 1988; Martin *et al.*, 1988).

Epidemics of certain diseases may be difficult and expensive to either diagnose, treat or control (Biggs, 1985). These lead to anxiety to the producer and the veterinarian. Even when a diagnosis can be made relatively easy, the clinical management of some diseases can be frustrating especially when they do not respond to therapy and have high mortality rates. Examples of such diseases are contagious bovine pleuropneumonia, rinderpest, brucellosis, coliform and nocadial mastitis, salmonellosis and acute undifferentiated diarrhoea of calves and many others. The difficulty of predicting the occurrence of disease also makes control uncertain (Blood and Rodostits, 1989).

2.2.1.3 Diagnosis;

The specific diagnosis of sub clinical infection is a major problem for the control and clinical management of many diseases (Martin, 1984). Being able to identify infected animals that could be carriers and shedders is a

prerequisite to the elimination and eradication of infection from a herd (Blood and Radostits, 1985). Sampling the necessary proportion of animals in a herd for laboratory diagnostic testing and interpreting the results correctly are important aspects of making an accurate diagnosis (Martin, 1984; Hancook *et al.*, 1988).

2.2.1.4 Principles Of Control;

Educating livestock producers so that they understand the importance of the various risk factors associated with infectious diseases and the strategies for the control is a challenging responsibility for the veterinarian (Burton *et al.*,1988; Williamson *et al.*, 1988). Many infectious diseases could be controlled effectively and economically if livestock producers adopted the management procedures that are effective and readily available. Producers adopt certain control procedures more readily if they understand the reasons for the procedure. Thus, it is the duty of the veterinarian to explain to the farmer each control procedure emphasising the advantages of doing such (Blood and Radostits, 1985; Martin *et al.*, 1987; Prescott, 1991; Radostits and Acres, 1980).

2.2.2 Effect Of Disease On Livestock Production In Developing Countries:

Infectious diseases of livestock are a major constraint to livestock production and economic development in Africa (Jawara, 1990). The tropical climate is extremely conducive to the growth and propagation of pathogens, and consequently the environment is rife with diseases and their vectors (Jawara, 1990). The major diseases affecting livestock are rinderpest, foot-and-mouth disease, contagious bovine pleuropneumonia, brucellosis, theileriosis and trypanosomiasis. Helminthiasis is significant and is a cause of high mortality especially in young animals (De Haans and Bekure, 1991). Ticks are also a major cause of disease in Africa (Jawara, 1990). Tick infestations directly depress the productivity of livestock but, more importantly, they are vectors of diseases like theileriosis, babesiosis, anaplasmosis, heartwater, and dermatophilosis (EEC Project, 1989; Fabiyi, 1984). Dermatophilosis is a primary production-limiting disease of cattle in humid areas (Abdullahi, 1982). Trypanosomiasis is one of the most important diseases in the subhumid and humid tropics of Africa (Jawara, 1990). It is obvious that animal diseases are a major constraint on the economic development of Africa and effective control depends on well-trained and educated personnel, availability of resources, management and a much needed interdisciplinary approach. Considerable efforts are being

carried out by many different agencies with regards to the economic control of these infectious diseases (Jawara, 1990).

2.2.3 Specific Infectious Diseases Of Food-Producing Animals:

The common infectious diseases of cattle that cause herd problems leading to low productivity and mortality in cattle include mastitis, diarrhoea of new-born calves, pneumonia, pasturellosis, infectious abortions, footrot, intestinal helminthiasis, ectoparasitism, brucellosis, tuberculosis, foot-and-mouth disease, trypanosomiasis, contagious bovine pleuropneumonia and dermatophilosis (Blood and Radostits, 1985, 1989).

2.2.3.1 Mastitis;

Mastitis is an inflammation of the mammary gland resulting from invasion of pathogenic micro-organisms through the teat streak canal (Blood and Radostits, 1985). It is most often sub clinical in nature, but can be manifested in clinical signs ranging from mild to peracute (Burton *et al.*, 1988). Subclinical mastitis is the presence of pathogenic micro-organisms in the milk and a somatic cell count above 500,000 cells per millilitre and

can only be diagnosed using screening tests (Shook, 1989).

Clinical mastitis is characterised by a wide range of findings, including abnormal texture and discolouration of the milk and by swelling, discolouration and increased temperature or pain of the gland. In mild clinical mastitis, the abnormalities are restricted to changes in the milk, whereas in peracute forms of the disease severe systemic illness is an early sign (Newbould *et al.*, 1982). Chronic mastitis often refers to a persistence and recurrence of changes in the milk for long periods. Occasionally, these chronic cases flare up into a more active form (Ferns *et al.*, 1991).

The causation of mastitis involves a complex relationship of three major factors: host resistance, microbial agents and the environment (Grommers, 1988). Host defence mechanisms are important in affecting the susceptibility of cows to udder infection (Grommers, 1988). The general resistance by the host relates to genetic predisposition, anatomic characteristics, nutritional status, stage of lactation, parity and the use of management procedures to enhance resistance (Bendixen, 1988; Cullor,1991; Jones, 1986; Lewin, 1989; Nickerson, 1987; Shook, 1989). The characteristics and habitat of specific microbiologic agents are important in the occurrence of mastitis (Jones, 1986). The influence of the environment on the interaction between

the agent and the host can determine the level of contact and greatly affect development of the disease (Bramley and Neave, 1975; Schukken *et al.*, 1988; Watts, 1988).

A wide variety of micro-organisms are capable of causing inflammation of the mammary gland. The degree of importance of a specific agent as a cause of mastitis in cows is largely dependent on the pathogenicity of the agent, the challenge dose required to cause infection and the amount of environmental influence on the host-agent interaction (Blood and Radostits, 1985). The major micro-organisms involved in causing mastitis in cattle can be characterised into two major classes of pathogens; contagious organisms and environmental organisms (Mathews *et al.*, 1989). Contagious mastitis is commonly caused by Staphylococcus aureus and Steptococcus agalactae. The predominant organisms that cause environmental mastitis are Streptococcus species and the coliform group of organisms (Bramley and Neave, 1975; Ferns *et al.*, 1991; Ollis *et al.*, 1991; Schukken *et al.*, 1988; Smith, 1986).

2.2.3.2 Parasitism;

In many countries of the world, parasitic infection is of major importance

in the animal production sector (Blood, 1979). In addition to the purely physical injury caused by external parasites, some of them serve as vectors of many viral, rickettsial, bacterial and protozoan diseases (Fabiyi, 1984). They have a marked effect on the production of meat and milk in Africa (Jawara, 1990). The occurrence and significance of tick-borne parasites among livestock, especially cattle in Nigeria have been reported (EEC Sponsored ABU/RUU Project Report, 1989). Tick borne diseases including babesiosis (Redwater fever), anaplasmosis (gall sickness), and cowdriosis (heart water) are responsible for much loss in cattle (Fabiyi, 1984).

Given an appropriate environment, gastrointestinal parasite may cause substantial losses in production, or even acute clinical symptoms and death (Morley and Donald, 1980). The disease causes a rather gradual deterioration of animal performance and does not show dramatic clinical symptoms especially in mature animals, except in younger ones, which exhibit gastrointestinal disorders and severe anaemia's (Okaeme and Ogwu, 1984). Developmental disorders, reduced milk production, poor wool quality, inferior carcass grades and sterility are all consequences of worm infestation (Mahammed *et al.*, 1989; Istifanus *et al.*, 1990; Ogunsusi, 1979; Georgi and Georgi, 1990.).

2.2.3.3 Bucellosis;

Brucellosis is a zoonosis and a disease of all worm-blooded animals caused by bacteria of the genus Brucella. It is primarily a disease of sexually mature animals wherein the inciting organisms circulate systematically for variable length of time depending upon the host (Bale, 1991). The major pathology of animal brucellosis include; abortion, stillbirth, dystocia, retained placenta, endometritis, neonatal mortality, infertility, mummified or macerated foetus or weak calf if born alive, mastitis, anaestrus, repeat breeding, prolapse in late pregnancy, epididymitis, sterility, orchitis, testicular atrophy. hygroma and septicaemia (Bale, 1991).

In the last three decades, more information has emerged on various aspects of brucellosis in Nigeria and some parts of Africa (Bale, 1991). The prevalence of brucellosis is not static, for the pattern of livestock keeping is constantly changing and the incidence of the disease is likely to be influenced by some of the changes in livestock husbandry management practice as well as by the extent of population movements (Bale, 1991). It is increasingly evident that brucellosis represents one of the major drawbacks to livestock production in Nigeria (Ocholi, 1990). However, a systematic and proper evaluation of economic losses due to various

brucellosis in different animal species and humans is lacking.

Various investigators in the country have shown that brucellosis is present in most private and dairy farms, government farms and institutional farms (Bale,1991; Nuru, 1975). Ocholi (1990) showed that brucellosis is now on the increase among the nomadic and semi-nomadic herds which is the main thrust on which the highest national cattle population rested. One of the reasons for this may be as a result of reduced grazing and watering areas during the dry season, as a result causing overcrowding and concentration of cattle at riverine and 'fadama' areas (Bale, 1991).

Economic losses associated with brucellosis include loss of calves, loss of milk, cost of replacement animals, retention of placenta, cost of vaccines and lowered value of animal culled due to the disease (Bale, 1991). Attempt has been made to assess the control cost of bovine brucellosis in Nigeria. Esuruoso (1979), based on the collected data obtained from brucellosis survey arrived at a total control amount of N148.80 million per year. Rikin (1985 cited by Ajayi, 1995) established that bovine brucellosis control in Nigeria over a span of 15 years will cost N29,494,000.00 per year. The study indicated that losses for 'no programme' continued to increase by nearly one million naira annually, whereas, under control programme the

losses decreased by nearly two million naira annually.

2.2.3.4 Tuberculosis;

Tuberculosis is a chronic disease caused by acid-fast bacteria, Mycobacterium species and affects practically all worm-blooded animals (Alhaji, 1976). It is characterized by the progressive development of tubercles in any of the organs of most species (Andrews and Walton, 1976). The bovine type is the most cosmopolitan and is capable of causing progressive disease in all warm-blooded vertebrates and presents a major source of human infection (Andrews and Walton, 1976). The tuberculous cow is the greatest source of danger to the healthy cattle (Ellis, 1974; Alhaji, 1976). An infected animal not properly removed from the herd is a source of potential re-infection (Alhaji, 1976). Among cattle, dairy breeds maintain behind closed doors with little ventilation and illumination are mostly infected through the ingestion of infected milk (Blood and Radostits, 1989). Humans are infected through inhalation and ingestion of droplets and infected milk and meat (Alhaji, 1976).

Bovine tuberculosis causes great economic loss and constitute a threat to continuous offspring, decrease in life span, insufficient utilisation of food,

decrease milk production, infertility, poor condition, interference with herd improvement programmes, and low market value (Alhaji, 1976). The disease have been reported to have a prevalence of as high as 25 % in some areas of Northern Nigeria. Alhaji (1976) found a prevalence of 2.5 % in North-eastern state and 3.2 % in Northwestern state of Nigeria. Ladan (1988) found a prevalence of 11.8 % in Zaria area. In an abattoir survey, Alonge and Fasami(1979) found a prevalence of 41.9 %. It is difficult to assess the economic importance of the disease in cattle. Apart from actual deaths, it is estimated that infected animals lose 10-25 % of their productive efficiency (Alonge and Fasami, 1979).

2.2.3.5 Dermatophilosis;

Dermatophilosis is an exudative disease of domestic and wild animals and to a lesser extent man, caused by the Actinomycetes, Dermatophilus congolense (Abdullahi, 1982). Among domestic animals, cattle, sheep, goats and horses are susceptible (Von Saceghem, 1915; Abdullahi, 1982; Bida, 1973; Saidu, 1986).

The organism survives in nature under dry conditions and in scabs as a mycelium though few zoospore could be seen. The mycelium is the

predominant form in skin lesions on susceptible host. It is very antigenic though antibodies produced against it are not protective (Richard et al., 1976; Bida , 1975). It is also resistant to desiccation, being viable for up to 42 months as zoospores in scabs (Oppong, 1976).

The disease caused by D. congolense has been reported all over the world with reports from Africa, Asia, Australia, Europe, South America and the United States (Von Saceghem, 1915; Hudson, 1937; Harris, 1948, Dean *ef al.*, 1961; Roberts, 1967; Saidu, 1986). It is more prevalent during the rainy season when predisposing factors like arthropods, wetness and tree branches are most abundant (Stewart, 1972). It has been shown that the organism is transmitted from one animal to another through body contact in the presence of skin discontinuity (Le Riche, 1967). The skin pathology due to the disease is well documented (Bida, 1973; Oduye, 1976).

The disease has been reported to be of great economic importance due to damage to hides and skins, loss of condition and possibly losses in production. The exact extent to which these losses affect I ivesto ck production are yet to be determined (Memery and Thiery, 1960; Kelley and Bida, 1970; Bida, 1973; Bwangamoi, 1976; Lloyd *et al.*, 1987; Nobel *et al.*, 1976, Oduye, 1976, Kumi Diaka *et al.*, 1980; Abdullahi, 1982, Saidu, 1986).

2.2.3.6 Foot and Mouth Disease (FMD);

It is a highly acute and contagious disease affecting all cloven footed animals (Blood and Radostits, 1989). The disease is characterised by the formation of vesicles and erosions of the tongue, nose, lips and other mucous membranes of the mouth and the skin between the hooves and around the coronary band above the hoof (Biggs, 1985). Its importance stems from losses that could result from mortality, loss of milk production, loss of condition, depressed growth, abortion, subsequent infertility and cost of control and eradication (Biggs, 1985; BVA Trust Project, 1982).

FMD is known to be widespread in Nigeria (Jawara, 1990). The distribution of the disease is not completely known because the system of disease reporting is not very efficient(Ajayi, 1995). The effect of FMD in Nigerian livestock has been described as mild with cow mortality resulting from it (Ladan, 1995). The cow mortality has tended to make Fulani herd owners think of FMD as a transient nuisance.

It is evident that what is reported is only a small fraction of total incidence of the disease and that economic losses resulting from loss of condition, retarded growth, abortion and infertility and loss of milk production could run

into millions of Naira (Ladan, 1995).

2.2.3.7 Contagious Bovine Pleuropneumonia(CBPP);

CBPP is an acute highly infectious disease of cattle cause by Mycoplasma mycoides var. mycoides characterised by marked oedema and proliferation of interstitial tissues in the lungs, diffuse pneumonia and serofibrinous pleuritis (Blood and Radostits, 1989). The disease is still enzootic in many large areas of Eastern Europe, Asia and Africa and is of major economic importance in Nigeria. CBPP is widely distributed in Africa particularly in the semi-arid zones along the southern border of the Sahara, extending from Somalia in the east to Senegal in the west (Osiyemi, 1981). In Nigeria, it occurs in the states north of the Niger and Benue river valleys (Mohammed, 1983). The free areas comprise the rest of the country. It is, therefore, clearly evident that the disease is restricted to the states at the northern border of the country (Ladan, 1995).

The survey of CBPP in northern Nigeria showed that for the past years, the country had been sustaining great losses as a result of outbreaks (Mohammed, 1983; Osiyemi, 1981). It has been generally agreed that the disease is of great economic importance not only because of direct losses

through death or loss of animal protein but moreso because of indirect losses due to the interruption of movement and sales of stock, production, restriction of external trade and cost of veterinary services (Ajayi, 1995). It is because of its economic importance that the first national campaign for the control and eradication of the disease named Joint Project 28 (JP 28) was launched in 1973. Since then the control of the disease in Nigeria has been through removal of clinical cases and annual vaccination of apparently healthy herds (Mohammed, 1983; Osiyemi, 1981; Onoviran, 1978).

2.2.4 Treatment Of Infectious Disease of Food-Producing Animals;

Animals affected with infectious diseases caused by bacteria are usually treated with antimicrobial drugs to minimise the effects on production, to prevent death and to prevent further spread of the disease by elimination of the infectious agent, if possible. Animals affected with certain viral infections, particularly of the respiratory tract, may also be treated with antimicrobials in an attempt to prevent secondary complications caused by bacterial infection. In some situations, all animals in a group may be treated prophylactically in order to reduce the incidence of disease (Harland *et al.*, 1991; Woolcook and Mutimer, 1983).

The use of antimicrobial drugs in food producing animals may result in drug residues in meat and milk, which is now a major public health concern (WHO, 1983; Von Dresser and Wilche, 1989). It is the responsibility of the veterinarian to educate the producer on the correct use of antimicrobials and to adhere to stated withdrawal times for each drug used (Blood and Radostits, 1985). The positive identification of each treated animal, as well as the keeping of appropriate records to indicate the date on which the animal was treated and with which drug, have become vital component of animal health management programme (Blood and Radostits, 1985; Von Dresser and Wilche, 1989). Veterinarians have a responsibility to use drugs at the proper dosage to justify their use by an extra-labelled route to provide specific information regarding withholding times and to recognise the privileges and responsibilities (Blood and Radostits, 1985).

In Nigeria, there is indiscriminate use of antimicrobial agents in food producing animals (Ladan, 1995). This is so because there is no regulatory body controlling the sales of antimicrobials to the public. This results in the use of these agents by unqualified personnel like the Fulanis themselves, to treat animals once they are sick, without a proper diagnosis (Ibrahim, 1986). That is why, resistance of micro-organisms to antimicrobial agents is increasing. Veterinarians in this country only attend to emergency visits

to farms, instead of a herd approach and this allows the farm managers to do most treatments themselves unless the situation is critical.

Of recent, the Fulanis, who owned most of the cattle in Nigeria, have resorted to traditional treatment of livestock diseases using local herbs due to high cost of orthodox medicines (Gefu and Otchere, 1994). Most of the treatments are for helminth, bacterial as well as viral conditions (Ibrahim, 1986; Ibrahim et al., 1983; Nwude and Ibrahim, 1980) and a significant success have been made using such herbs (eg Khanya senegalensis, Dichrostachys glomerata, and Boswelia dalzelii) to achieve treatment (Gefu and Otchere, 1994).

2.3 DAIRY HERD HEALTH PROGRAMME:

In the developed countries, remarkable changes have occurred in the dairy cattle farming in the last 35 years and new developments continue to occur (Blood and Radostits, 1985). Increasing specialisation of milk production on commercial dairy farms and stability of the milk supply have characterised the last 35 years of dairy production in the United States (Blood, 1979). During this period, the national dairy herd decreased from 21million to less than 11 million milk cows. This dramatic decrease in dairy

farms and dairy cows numbers has not affected the supply of milk (Dunkley and Pelissier, 1981; NovaKovic and Jack, 1990). Fewer farms, larger herds, and more production per cow reflects the impact of developments in the sciences of genetic selection programmes, nutritional management and management of the health and production of dairy cattle (NovaKovic and Jack, 1990).

In Nigeria, the dairy industry is not well developed. Cows commonly are pastured and fed minimal grains during the drier months and are generally housed in loose housing barns. This is mainly seen in some institutional farms. Most of the industry is in the hands of the Fulani cattle rearers, who rely on indigenous technology, hand milking with no proper supplimentation, hence more needs to be done (Bogoro *et al.*, 1994).

2.3.1 Components Of A Dairy Herd Health Programme;

Dairy herd health programs vary depending on the goals, values and motivations of the producer and on the desire of the veterinarian to offer the service (Blood *et al.*, 1978). In the simplest form, a farmer deliberately sets out to improve his herd's performance by improving his management, especially the milking parlour, hygiene and breeding techniques. In such

situation, the veterinarian is used only for emergency service (Goodger and Ruppanner, 1982a).

A herd health programme consist of regularly scheduled visits by the veterinarian in which all matters of health maintenance, especially the means of keeping reproductive efficiency high and mastitis and calf mortality low are discussed and individual animal or groups of animals are examined and treated in order to achieve this end (Howe, 1988). The major theme is constant surveillance of health and production and the identification of failure to meet certain production objectives or targets. Other programs include examination of reproductive performance, nutrition, calf health management and housing (Smith, 1977; Waheed *et al.*, 1977).

2.3.1.1 Health Management Of Dairy Calves;

The successful rearing of dairy calves as herd replacements depends on a well-managed combination of early feeding of colostrum, adequate housing and adequate nutrition following the colostral feeding period (Bigrass-Poulin *et al.*, 1984b). The infectious diseases of digestive and respiratory tracts are the most important diseases of calves from birth to several months of age (Harland *et al.*, 1991). Approximately, 75% of the

mortality of dairy animals under one year of age occurs during the first month of life. This serve to point out the necessity of giving high priority to a health management system for rearing new born calves, especially during the first month of life (Blood and Radostits, 1985).

The economic loss in dairy calves from birth to six month of age is due to mortality and sub optimal performance caused by the following diseases or inadequacies in production management: abortion, stillbirth, congenital defects, acute diarrhoea, chronic diarrhoea, omphalophlebitis, enzootic pneumonia, nutritional diseases and parasitic gastro-enteritis (Blood and Radostits, 1985).

2.3.1 Milk Production In The Tropics;

There is considerable interest in milk production in the tropics and subtropics, particularly in developing countries (ILCA, 1990). Some veterinarians have participated in educational and extension programmes in an attempt to increase milk production in tropical countries that are densely populated and where there are large areas of maginal land that could be developed with some pastures (ILCA, 1990).

There is a notion that tropical countries have an abundance of green grass year round that should support high levels of milk production. This is not necessarily so (Jawara, 1990). The key factor limiting animal production is inadequate nutrition of livestock maintained under tropical conditions (Tewe, 1995). Some of the causes of lowered production include heat stress , which decreases feed intake, high environmental temperature, which may decrease dry matter digestibility by ruminants, natural grazing land of low productivity and the slow development of improved pasture and irrigated forage because of limitations imposed by technical, economic and human factors. Mineral deficiences are also common and the pasture are low in energy and protein.

2.3.3 Maintening Reproductive Efficiency In Dairy Cattle;

Dairy cows are mammals and produce milk only after calving. Because milk is the major source of income for a dairy farm, the general goal is for cows to produce a maximum amount of milk per day of life at a minimum of feed (Blood *et al.*, 1978). To do so, cows should calve at regular intervals and therefore must be bred and become pregnant within a constant period of time (Brith, 1975). If conception is delayed, reproductive inefficiency can lead to milk production inefficiency (Galton *et al.*, 1977). Other economically

important objectives of reproductive programmes are reduced culling because of reproductive disease, increased genetic selection opportunities, reduced need for treatment of reproductive diseases and earlier first calving in heifers (Galton *et al.*, 1977). In most cases, these economically motivated objectives for a reproductive programmes are not the parameters most closely watched as veterinarians monitor the efficiency of reproduction on dairies. Instead, the veterinarians tend to focus on the more direct biologic outcomes of the reproductive process (Bradford, 1989). Reproductive outcomes such as days from calving to conception (open days), conception rates, measures of oestrus detection efficiency and disease and abortion rates are of primary importance when analysing dairy reproductive programmes (Fetrow *et al.*, 1990; Ferry, 1992). A calving interval of 12 months (85 days open) has been associated with yielding the optimal amount of milk and number of calves over the lifetime of the cow in most circumstances (De Kruif and Brand, 1978; Brith *et al.*, 1981; Brith, 1975). It is possible that for high producing herds the optimum interval may be longer than 12 months (Brith, 1975).

This sub-optimal level of reproductive performance in dairy herds is matched by the knowledge that, in some herds, substantially better performance is achieved. The systems that are successful include those

with excellent nutrition, committed management, intense oestrus detection with the strategic use of prostaglandin, routine genital examinations and early treatment of abnormalities detected in these examinations and careful breeding at the proper time. There is a great deal of field evidence that this improved reproductive performance is profitable (Morris *et al.*, 1978; Whitaker, 1980; Galton *et al.*, 1977).

2.3.3.1 Causes Of Reproductive Inefficiency;

The reason for failure to attain an acceptable calving interval or average days open can be either managerial errors (in which the cow is not mated) or reproductive failure (in which the cow is mated but conception or the birth of a live calf does not result) (Eduvie *et al.*, 1993). The relative importance of each of these causes varies widely from place to place and even from time to time on one farm, depending on the level of preoccupation of the farmer with the problem of getting the cow pregnant (Eduvie *et al.*, 1993). When farmers do not give high priority to reproduction, too little labour, time and attention are given to such matters as detecting oestrus, inseminating cows at the best time, diagnosing pregnancy.

Among the defects of ovarian function and structure, the important ones

are anestrus, subestrus, and cystic ovaries, which account for 70% of treated infertility cases (Roine and Selcniemi, 1978). Fertilisation failures and embryonic mortality also contribute as causes of reproductive failure (Eduvie, 1985). Factors that are known to decrease ovum fertilisation rates include low fertility of bulls and insemination after ovulation (Kummerfield *et al.*, 1978). Embryonic mortality may be associated with several previous infertile services and the fertilisation of aged ova, but the real causes of most embryonic deaths are unknown (Sreenan and Diskin, 1983).

Reproductive performance can be improved in each of the two major problem areas- oestrus and infertility- by applying existing knowledge (Morris *et al.*, 1978). For example, the intense and accurate detection of oestrus would shorten calving intervals by providing more frequent opportunities to inseminate cows and by improving fertility through the better timing of insemination relative to ovulation. In cows with diagnosable disease problem, the rate of embryonic mortality is probably stable although subject to decrease by reducing the mortality caused by poorly timed insemination or by such identifiable factors as high environmental temperature and humidity and use of semen from low fertility bulls (Kummerfield *et al.*, 1978). Other managerial decisions that are critical to high reproductive efficiency include positive action to prevent the

introduction of reproductive diseases e.g. brucellosis into the herd (Galton *et al.*, 1977).

2.3.3.2 Regular Physical Examination Of The Reproductive Tracts;

The reproductive performance of the herd can be evaluated monthly or more frequently in large herds, by the physical examination of the reproductive tracts of cows (Voh Jr. *et al.*, 1994). The emphasis is on the examination of cows for pregnancy especially cows that fail to come into oestrus by a certain time after calving and those that do not conceive following breeding (Whitaker, 1980). Regular visits by a veterinarian are the basis for all modern reproductive herd health programmes (Blood *et al.*, 1978).

2.4 BEEF CATTLE HERD HEALTH PROGRAMME:

Beef cattle enterprises vary widely between countries and even within countries. The cattle industry is one of man's most valuable renewable resources and provides farmers with the most efficient means of utilising forages grown on million of hectares of forest rangeland and pastures (Koch and Algeo, 1983). Consumers' demand for lean yet tender tasty beef was

It is assumed that emergency services are provided at a level that is mutually satisfactory to the farmer and to the veterinarian. In many such associations, these are added to the standard components of preventive medicine relevant to the particular farm, including testing for tuberculosis and brucellosis and control of these diseases, strain-19 vaccination, other vaccinations, drenching for worms, spraying for ectoparasites, pregnancy diagnosis and many others (Church, 1980). There is no attempt to accurately measure productivity of the herd or if there is the productivity index is not related to the intensity of disease control.

The ability of the veterinarian to provide the herd health and production advice is a major factor that limits the extent to which beef farmers will utilise the service (Blood, 1979). Most veterinarians engaged in beef cattle practice are also involved in general farm animal practice and they are not always available to spend the time necessary to properly evaluate a beef herd (Blood, 1979). The animal health and production problems of the various aspects of the food animal industry will be best served by species or industry specialists, in this case beef cattle veterinary specialists in private practice and not employed by a government agency (Bradford, 1989). Another major factor that affects the practicability of a beef cattle herd health service is the seasonality of the work. It is extremely difficult for

CHAPTER 3

3.0 MATERIALS AND METHODS

3.1 THE STUDY AREA:

Bauchi Local Government Area lies between latitude 10°N and longitute 10° 30" E and at an altitude of 690.2M above sea level (Bauchi State Urban and Regional Planning, 1992). Bauchi State has an average annual rainfall of 1091.4mm. The peak of the rain occurs in August with the highest relative humidity of 66.5% and the lowest of 16.5% in February. The mean maximum temperature of 37.5°C occurs in April and the minimum 13.7°C in January (Meteorological Station, Bauchi Aerodrome, 1993-1995).

Bauchi state is located within the Northern Guinea Savannah vegetational belt of Nigeria. The area is known to compose of mainly grassland and a few or sparse trees. The commonest forage grasses found in the area include: *Andropogan gayanus, Pennisetum pedicellatum* and legumes such as *Centrosema pubescens, Desmodium* species and *Stylosanthes guinensis*. The main occupation of the inhabitants of the state is farming. Bauchi state has about 25% of Nigeria's total livestock

population (Ajayi, 1995). Cattle are mainly fed crop residues during the dry season (with or without supplementation) and on fresh grass during the rainy season.

3.2 LIVESTOCK MANAGEMENT SYSTEM:

Livestock in the study area are managed under two (2) types of management systems viz; extensive and semi-intensive systems. Those who practise the extensive system of management are essentially sedentary throughout the year. The agropastoralists practise limited transhumance at the end of the crop growing season to graze predominantly maize and sorghum residues during early December to the end of May. Bulk on offer decreases so fast that a critical nutritional stress period occurs during the pre-rainy season (mid May to mid June). Some affluent livestock owners practice the semi-intensive management system where the animals are led out to graze during the day and confined into paddocks at night fall, with occasional supplementation with crop residues and /or cotton seed cake during the dry season. Watering is done in streams, ponds or borehole depending on availability, accessibility or ownership

There are no deliberate management system or strategies aimed at

controlling the breeding season. Bulls run with the breeding females all the time thus allowing cows to conceive throughout the year, thereby spreading pastoralists income from milk sales. Lactating cows are milked often twice a day, in the mornings and evenings for human consumption. Calves are allowed to suckle their dams for about a minute, to stimulate milk let-down prior to partial hand-milking.Calves suckle their dams until they stop suckling on their own accord. There are no special practices relating to calf management.

3.3 SELECTION OF HERDS:

Farms were selected within Bauchi Local Government Area to cover the management systems described earlier and breed of the cattle. The Zebu breed (Cattle indigenous to Northern Nigeria) were the only breed used in this study. Only owners that were willing were chosen. The location of the herds is shown in the Map (Appendix 1).

Initially, 16 herds were chosen. By the end of the study period , detailed information was obtained for only 9 herds.

3.4 FIELD WORK/ OBSERVATION:

The field work covered between January 1993 and December, 1995. Planned periodic monthly visits were made to each herd or on the invitation of the herd owners whenever they had cause to. At the start of the study through the end, every animal, in each herd, was examined individually. As only 5 herds had crushes, in the rest of the herds where there were no crushes, each animal was tied separately. Each animal in all the herds was identified using eartags, hausa names or fulbe names and /or hair coat colour. Details of the age, sex, and breed for each animal in all the herds were recorded. Ageing of the animals was done by using a combination of eruption of the permanent incisors (Akerejola and Ojo, 1976) and questioning of the herd owners as to the age of the animals.

On each monthly visit to each herd, blood and faecal samples were taken and examined for haemoparasites (mainly *Anaplasma* and *Babesia*) and helminths (mainly strongyles) using the thin smear method and floatation method respectively. Also at the beginning of the study and yearly, all herds were vaccinated against rinderpest, contagious bovine pleuropneumonia (CBPP), blackquarter, and haemorrhagic septicemia. At the beginning and at the end of the study, all and the available herds were

screened for tuberculosis and brucellosis. Rectal examination was done on each visit to check for pregnancy and or ovarian activity. Palpation for pregnancy and ovarian activity was carried out as described by Osori(1976), Abbitt *et al.*, (1978)., Eduvie and Dawuda., (1986) and Voh jr. *et al.*, (1994).

At each visit, herd structure, breeding method, reproductive status of breeding cows, vaccination history, prevalent diseases, mortality and morbidity feeding methods and types of feed, housing and enviroment and all calves born in these herds were recorded. Sick animals were examined and samples taken as required for laboratory analysis. Most of the animals were treated. However, to help retain the owners co-operation, a certain amount of free clinical treatment was given to sick animals. Advise on management in general was given to each herd owner if they care to listen. Postmortem examination was carried out on all dead cattle and diagnosis made from gross lesions.

3.5 TUBERCULIN TESTING OF THE HERDS:

The test was conducted on all cattle in the 16 herds at the beginning of the study and 9 of the herds at the end of the study using the single intradermal cervical comparative test.Two types of tuberculin obtained from

the Central Veterinary Laboratory, Weybridge were used. They are:

a) Weybridge avian purified protein derivative(PPD) 0.5mg per ml.

b) Weybridge bovine purified protein derivative(PPD) 1.0mg per ml.

The site of the injection for both tuberculin types were middle third of the right side of the cows neck. The avian type was injected in the upper site (122mm) below the crest; and the bovine type was injected in the lower site (127mm) from the other type on a line parallel to the line of the shoulder. Tuberculin syringe and needle (McLintock) was used. The hair was clipped off an area of one inch in diameter. The raised fold of the skin was measured with a calliper and recorded. The needle was inserted with the bevel edge outwards and obliquely into the clamped fold of the skin, and 0.1ml of tuberculin was injected. The reaction of the test in the form of swelling was measured after 72 hours and recorded in millimetres. The difference in the size of swelling between the avian and bovine readings was obtained. An increase of more than 2mm in the bovine as compared to that of the avian was regarded as positive reaction (Alhaji, 1976).

The result of such an intradermal cervical comparative test was recorded and non-specific tuberculin reaction was recorded when the animal reacted

with the avian tuberculin type only (Alhaji, 1976).

3.6 SCREENING FOR BRUCELLOSIS:

3.6.1 Specimens;

Blood samples were collected from all the cattle in the 16 herds at the start of the study and the remaining 9 herds at the end of the study, through venipuncture of the jugular vein into sterile tubes . The blood was allowed to clot and serum was extracted and stored at -20 oC until analysis.

3.6.2 Serologic Study;

The serum samples were tested for brucellosis by Microtitre Serum Agglutination Test (MSAT) (Central Veterinary Laboratory brucellosis manual 1991). The antigen for the test was standardised against the international standard anti-Brucella abortus serum so that 50% agglutination occurred at a dilution between 1:600 and 1:1000.

The test was carried out using a 96 wells 'V' or conical bottom microtitre plates. The plates was divided vertically into 3 test wells such that each held

32 tests in all. Eighty microlitres (80µl) of normal saline was pipetted into the first well of each test and 50µl into the remaining two wells. Then, into the first well of each test, 20µl of the test serum was pipetted. Using a multi-channel pipette, the contents in the first wells were mixed and 50µl were picked and transferred to the second wells which were mixed and 50µl transferred to the third wells. Clean tips were used for each row of eight tests. Each well contained 50µl of diluted serum at 1:10, 1:20, and 1:40. Fifty microlitre(50µl) of antigen at working strength were added into each well after prestaining with safranin (which serve as indicator of the reaction). The titre plates were covered with lids and sealing tape and mixed thoroughly for approximately 30 seconds. The plates were incubated in a humidified atmosphere at 37°C for 20 hours. Negative and positive controls were set up with each batch of test using the first and the second test wells of the first row of the tests. The negative and positive sera were also obtained from the Central Veterinary Laboratory, Weybridge.

3.6.3 Reading The Result;

The result was read by examining the bottom of the wells reflected in a concave mirror placed above the plate. A negative reaction gave the antigen sedimenting in the form of compact buttons with clear edges and having

an intense red colour while in a positive reaction, a diffused veil, that was evenly distributed, was formed at the bottom of the wells.

3.7 ETHNOVETERINARY STUDY:

During the visit to the herds under study, it was realised that some herds (the fulani herds that practised extensive management system) were using some parts of tree plants (maily leaves and bark) to treat various disease conditions caused by bacteria and viruses. Thirteen (13) of this plants were screened for antibacterial and antiviral activity in-vitro.

3.7.1 Plant Extracts;

Dried and ground leaves or bark or both of the plants collected were soaked in distilled water and left over night (in conformity with the way they are prepared by the fulanis). They were then filtered using filter paper and 0.2um aquadisc filter, to sterilised the extract and stored at 4°C until use. The concentration of each filtrate was 1:10.

3.7.2 Tissue Culture and Antiviral Testing.

This was done as described by Vanden Berghe et al., (1986).

Human colonic cancer cells (HT-29) were used to grow three viruses_ *Poliovirus, Astrovirus* and *Herpes Simplex Virus*. The growth media for HT-29 cells consisted of 500ml of GIBCO medium 199 modified Earle's salts (with sodium bicarbonate and L-glutamine), to which 10% of heat-inactivated foetal calf serum was added. To the stock solution, 10ml procaine-streptomycin (5000 units of procaine and 5000ug streptomycin per ml) and 5ml fungizone were added and stored at 4°C until use.

3.7.2.1 Infection Of Cell Culture With Virus;

Three millilitre (3ml) of infected HT-29 cell culture stock with complete cytopathologic effect (CPE) was pipetted into a flask of confluent HT-29 cells. The flask was observed every day for CPE. All infected tissue cultures with complete CPE were pooled into a 500ml Scott bottle and the entire volume concentrated to give about 7ml of concentrated virus after adding dimethyl-sulphoxide (DMSO). This was done for each virus. The concentrated viruses were stored separately in 1ml eppendorfs and store at -70°C until use.

3.7.2.2 Infection of Cells And Treatment With Plant Extracts;

A 100ul of diluted HT-29 ce lls was pipetted into each well of a 96-well microtitre plate and incubated for 4 days at 37°C in a humidified CO_2 incubator until a monolayer was obtained. The plate was divided vertically into 5 columns of two wells each. Into the first column, 100µl of only plant extract was added into all the wells. The second column had concentrated viral solution only in all the wells. In the third column, 100ul of plant extract and viral dilution of neat to 10^{-6} were added from top to bottom. In the fourth and fifth columns, 10^{-1} and 10^{-2} dilutions of plant extract were added from top to bottom respectively and the dilutions of virus added as in the third column. The plates were incubated at 37°C in CO_2 for 4 days.

After 4 days, the plates were stained with crystal violet (0.25%) after fixing in 10% formal-saline for 30 to 60 minutes. The plates were washed after an hour of staining and air dried. Each well was then examined for clearance and non-clearance respectively.

3.7.2.3 Interpretation Of Results;

The first column showed the effect of the plant extract on the cells to

eliminate whether it was cytotoxic or not. Any clearance here indicates that the plant extract is toxic. The second column showed the pathogenicity and served as control for virus. There should be clearance in most if not all of the wells. The third, fourth and fifth columns showed the effect of the plant extracts on the virus. Clearance indicated that the plant extract has no antiviral activity.

3.7.3 Test For Antibacterial Activity;

This was done as described by Ibrahim *et al.*, (1983).

3.7.3.1 Test Organisms;

All test organisms were clinical isolates obtained from different patients diagnosed as having bacterial infections. The following micro-organisms were used: *Pseudomonas aerogenosa*,(control and multi-resistance strain) *Enterobacter*, *Enterococcus faecalis*, *Corynebacterium pyogenes*, *Streptococcus pneumoniae* (penicillin resistant) and *Staphylococcus aureus*. Cultures of the bacteria were maintained on nutrient agar at 4°C. Prior to testing, the bacterial cultures were subcultured on Mueller-Hinton medium at 37°C for 24 hrs.

3.7.3.2 Antibacterial Testing;

The hole-plate diffusion method was used to test the plant extracts against the bacteria. For the hole-plate method, 0.05ml of the appropriate bacterial suspension was thoroughly mixed with 25ml of sterile liquid Mueller_Hinton agar and poured into presterilized petri-dishes. The agar was left to set and 10mm core of agar was removed from 5 positions on the seeded agar dish using a sterile cork borer. Each well was aseptically filled with 0.2ml of each plant extract. Control plates with known antibiotics were set in the same manner. After holding at 4°C for 1 hour, to aid diffusion of extract, the plates were incubated at 37°C for 1h. Zones of inhibitions were measured in millimetres. Inhibition of growth was judged by comparison with growth in control tubes prepared without plant extracts, which were set up at the same time as the tests tubes.

3.8 INTERVENTIONS:

During the course of the study, each herd visited was given advice, depending on the need at that time, on most aspect of production management.

The recommendations were as follows

a. Yearly vaccinations against all endernic diseases like rinderpest, CBPP, anthrax etc.

b. Three monthly deworming of the herds especially during the rainy season.

c. Tick spraying at two weeks interval during the rainy season.

d. Culling of diseased and unproductive animals.

e. Provision of feed supplementation especially during the periods o f scarcity.

g. Employing qualified staff who could read and write to keep good records and manage the farm well.

3.9 STATISTICAL ANALYSIS:

The relationship between cycling , nutrition and ectoparasitism were subjected to chi-square analysis. Mortality and survival rates were analysed using the life-table method; incidence of diseases were calculated using the cow-month method and seasonal distribution of some diseases determined using the ratio-to-moving-average method (Remington and Schork, 1970).

Also cause-specific-case fatality rates and simple percentages were used to highlight some of the results.

CHAPTER 4

4.0 RESULTS:

4.1 LIVESTOCK MANAGEMENT SYSTEM:

The livestock management systems in the study area were semi-intensive system and extensive (Table 1). The management system was found to be the same in almost all the herds, including the extensive system, the only difference is that in the extensive system, animals are kept in the open at night. All the herds grazed natural pasture with little supplementation in the herds that practise the semi-intensive system.Their water sources were varied and included streams (25%), ponds (37.5%), wells (18.8%) and in very few cases borehole (18.8%). Most of the farms were headed by illiterate herdsmen who could neither read nor write, except the government and institutional farms. It was also observed that non-governmental and non institutional farms were not utilising the available veterinary services but instead the services of quacks especially in emergency cases. All the farms had no records and so the author had to start the record systems in these farms.

4.2 HERDS SURVEYED:

Sixteen (16) herds consisting of 702 cattle were surveyed during the first year of the study. By the second year and the beginning of the third year, 7 herds, namely Buba, LIBC, Barami, Galambi, Bishi, Miri and Maikano dropped out of the study and so only 451 cattle were surveyed (Tables 2, 3, & 4). The herds lost consisted of fulani herds and a government herd that was closed down (Table 4). The fulani herds were lost due to suspicion that the study was for cattle tax assessment and or because of recommendations regarding the removal of diseased animals (mainly due to tuberculosis).

The distribution of cattle in all the herd based on sex on yearly bases are given in Tables 2, 3, and 4, which show that there were more females than males but not in the right ratio. The ratio varied from farm to farm and ranges from 1:3 to 1:7. It also showed a yearly increase in the population of animals in most herds.

4.3 DISEASES:

The yearly distribution of parasites in the herds is given in Tables 5, 6, 7, 8 and 9. The incidence of haemoparasitic infection showed that the

infection decreased in all the herds studied for at first two years, except Kobi, Bula and Tahir farms, where the incidence in the third year is slightly higher than that of the second year, but the overrall result showed that the incidence decreased (Table 5). Kobi, Bula and Tahir farms had high incidence in the third year because more animals were added to the herds. Also, it was found that infection with *Anaplasma* in all the Herds was more than that with *Babesia* (Table 6 and 7). In the first year of study, Buba, LIBC, University, Tahir, and Kobi farms had high incidence of *Babesia* (0.8/100 cow-months, 0.9/100 cow-months, 1.4/100 cow-months, 0.5/100 cow-months and 1.2/100 cow-months respectively) and *Anaplasma* (10.2/100 cow-months, 7.8/100 cow-months, 6.8/100 cow-months, 6.4/100 cow-months and 5.7/100 cow-month respectively) infections which reduced in the second year, for *Babesia* (0/100 cow-months, 0.5/100 cow-months, 0.2/100 cow-months, 0/100 cow-months and 0.4/100 cow-months respectively) and *Anaplasma* (2.9/100 cow-months, 2.5/100 cow-months, 4.8/100 cow-months, 0/100 cow-months and 2.8/100 cow-months respectively) and even reduced further in the third year due to improved management in the area of tick control (Table 6 and 7). Seasonal distribution of haemoparasites as shown in Fig. 1, indicates high prevalence during the rainy season. The peak of the infection was in July which is the period with highest amount of rain in Bauchi.

Similar yearly distribution was noticed with helminthiasis (strongyles) infestation as in haemoparasites and the rate of infestation decreased during the course of the study. This was also due to the deworming programme instituted (Table 8). Infestation with ectoparasites (Table 9) gave a similar pattern as that of haemoparasites and helminths (Fig. 1). Common species of ticks identified were *Amblyoma* and *Hyaloma*. The general picture, in this study, was that diseases caused by haemoparasites, gastrointestinal(strongyle) parasites, and ectoparasites occur mostly during the rainy season in the study area (Fig 1).

Results of screening tests for tuberculosis and brucellosis, at the beginning of the study, are presented in Tables 10. A total of 40 reactors, for tuberculosis, were found in all the herds with Miri, Maikano and Bishi farms having the highest percentage of reactors (32.5%, 9.2% and 16.3% respectively). Also, 32 reactors were found for brucellosis in all herds with Jumba (9.8%), Kobi (8.1%), Bishi (10.8%), and Oska (6.6%) having the highest percent infection. All reactors were recommended for culling and were removed within the first year of study except in Barami, Galambi, Bishi, Miri, and Maikano farms. All other new purchases were tested before adding to the herds. Reactors in 5 herds above were not removed by the farmers and so led to their dropping from the study for fear of being prosecuted. At

the end of the study, reactors to tuberculosis and brucellosis dropped from 5.6% and 4.5% to 0.7% and 1.2% respectively (Table 11). In all herds, cattle were culled due to chronic dermatophilosis (64.9%), old age (16.2%), malnutrition (5.4%), reproductive failure (1.6%) and tuberculosis and brucellosis (11.9%) (Table 13 and 14) Dermatophilosis was the single condition that accounted for most of the culling (64.9%) in all the herds with Jumba, Kobi, Oska, Bula and Tahir farms having the highest culling incidence (Table 14). The incidence of culling by season is given in Fig 2 and Fig 3, where it showed that most culling, for all conditions especially dermatophilosis were done during the peak of the rainy season (June to September) and during the harmattan period (December to January).

The incidence of mortality (adults and calves), expressed in cow-months and calf-months, are given in table 15, for all the herds. Higher incidence of mortality was seen in Kobi (2.1/100 cow-months), Oska(2.0/100 cow-months), Bula(1.6/100 cow-months), Jumba(1.5/100 cow-months), Tahir(1.7/100 cow-months), Barami(1.8/100 cow-months and Maikano(1.9/100 cow-months) farms, which are private than Governmental herds. A similar picture was observed in the incidence of mortality of adult cattle in the herds, with Kobi (0.5/100 cow-months), LIBC (0.7/100 cow-months) and Barami (0.7/100 cow-months) farms having the highest

incidence (Table 16, Fig 4). However, more calves died in the governmental farms than in private (Fulani) herds (Table 17, and 18, Fig. 5). The yearly calf mortality rate is presented in Table 18. In almost all the herds, the rate dropped with year, especially in the herds that were studied for 3 years (Fig. 6). The overall mortality rates showed that all calves born in Barami farm died, while Oska and Kobi farms showed mortality rate of 78.6% and 63.3% respectively.

The combine monthly mortality rate for both adult cattle and calves is shown in Fig 7. The trend was that they died mostly during rainy season (June to spetember) and during period when food is scarces (February to March). Calf mortality by age of calves for the herds studied from 1993-1995 is given in Table 19. More calves (66.9%) died within the first 3 months of life (Table 19, Fig 8). Thus, the older the calf the more chances of survival (Fig 9).

The cause-associated case-fatality rates for adults and calves in the herds under study are given in table 24 and 25. The result showed that of all the cases in adult cattle 18.8% died of plant poisoning, 14.3% died of foot-and-mouth disease, 12.5% died of coccidiosis, 13.3% died of septicaemia and 11.1% died of contagious bovine pleuropneumonia. On the other hand, the common causes of death of calves included septicaemia,

coccidiosis, malnutrition and gastro-enteritis. In both groups, however, septicaemia due to unknown aetiology was the main killer. The prominent diseases for calves in the herds were calf scour and pneumonia (Table 25).

4.4 REPRODUCTION:

4.4.1 Parity:

The distribution of parity relative to age of cows is given in Table 26. Most of the cows (59.4%) became pregnant for the first time between the age of 4 and 5 years. Only 7.6% of the population of multiparous cows had more than 2 calvings while 0.5% had more than 3 calvings (Table 26). Most multiparous cows were either culled due to disease or dead due to malnutrition.

4.4.2 Reproductive status:

The total number of animals pregnant in the herds during the study period and the outcome of such pregnancies are given in Fig. 10. Most of the causes of abortions were not investigated, only 2, in the first year, were due to *Brucella abortus*. Most stillbirths occurred in the fulani herds. The

result showed that the number of pregnant animals that calved over the years increased from 62% in the first year to 70% and 78% in the second and third years respectively. Stillbirth and abortions declined from 16% and 18% to 13% and 14% and 12% and 10% respectively.

The yearly calvings and calving rates by farm are presented in Tables 27and 28. There was a general improvement in the calving rates in all the herds as the study progressed to the third year particularly in Fawu farm from 14.8% in the first year to 18.2% and 25% in the second and third year respectively), Oska farm(17.2%, 31.2% and 59.1% for the first, seond and third years respectively) and Bula farm (29%, 37%, and 56.7% for the first, second and third years respectively). The reproductive status of all postpartum cows relative to the postpartum period is given in Table 29. Majority of postpartum cows (62.3%) resumed cycling 6 months after calving. Also a good number oi cycling cows were not pregnant.

4.4.3 Calving Interval:

The average calving intervals for all the herds are given in Fig. 12. In all the herds, majority of the cows had calving intervals of more than one year (Table 30).Tables 31, 32, 33 and 34 show the effect of parasitic infections

and nutrition on cycling. Table 32 showed the relationship between endoparasite(Strongyles) and cycling. Endoparasites (Strongyles) did not appear to affect cycling ($P>0.05$) in all herds studied. Statistically it was also found that low level of nutrition affected cycling ($P<0.05$) (Table 33) and thus pregnancy ($P<0.01$) and calving interval in all the farms (Table 34).

4.5 ETHNOVETERINARY STUDY:

Six (6) of 13 plant samples used by the fulanis for the treatment of enteric diseases had antiviral activity against *Poliovirus* and *Astrovirus* and were not cytotoxic (Table 35). The rest were cytotoxic and hence were not used in the antiviral and antibacterial tests (Table 36). Table 37 shows the result of the antibacterial test of the different plant extracts. Most of their activity were against Gram positive organisms and only two, *Anogeoissus schimperi* and *Anocardium occidentale*, had some activity against Gram negative organisms. The active ingredients of these plants were not determined.

4.6 INTERVENTIONS:

During the course of the study, the following interventions measures

were suggested to and accepted by the herd owners.

The recommendations were:

a. Yearly vaccinations against all endemic diseases like rinderpest, CBPP, anthrax and black quater.

b. Three monthly deworming of the herds especially during the rainy season.

c. Tick spraying at two weeks interval during the rainy season.

d. Culling of diseased and unproductive animals.

e. Provision of feed supplementation especially during the periods of scarcity.

The result of yearly vaccinations and periodic treatment of herds against parasitic and other infections in all the herds showed an increase in production variables like calving (Table 27), cycling (Table 29), and decrease in both adult and calf mortality (Table 16 & 17). However, all farms could not supplement feeding properly especially during the dry season and could not employ professionals to manage the herds properly. Thus, good records were not kept, diseases and other conditions were not reported on time and the most significant problem due to this was that no records of purchases and income were kept. The owners refused to

cooperate on such. Even in the institutional farms, same problem was observed. The result of this was that the cost-benefit analysis of all the production systems could not be calculated.

Table 1: Location, Management and Size of Herds Surveyed At the Beginning of the Study.

Farm	Location	Management System	Size
University Farm	Yelwa/Gubi	Semi Intensive	30
Fawu Farm	Zalanga	Semi Intensive	45
Kobi Farm	Rafin Zurfi	Semi Intensive	70
Oska Farm	Gubi	Semi Intensive	61
Jumba Farm	Gubi	Semi Intensive	44
Bula Farm	Gubi	Semi Intensive	30
State Poly. Farm	Yelwa	Semi Intensive	30
Buba Farm	Kundum	Semi Intensive	30
LIBC	Darazo	Semi Intensive	35
Giwo Farm	Kagadama	Semi Intensive	38
Tahir Farm	Kangere	Semi Intensive	28
Barami Farm	Darazo	Extensive	20
Galambi Farm	Galambi	Semi Intensive	16
Bishi Farm	Bishi	Extensive	37
Miri Farm	Zamfara	Extensive	40
Maikano Farm	Gubi	Extensive	106

Table 2: Sex Distribution of Cattle in 16 Herds in Bauchi (1993).

Farm	Male	Female	Total
University Farm	6	24	30
Fawu Farm	12	33	45
Kobi Farm	24	46	70
Oska Farm	17	44	61
Jumba Farm	13	48	61
Bula Farm	9	35	44
State Poly. Farm	6	24	30
Buba Farm	7	23	30
LIBC	7	28	35
Giwo Farm	9	29	38
Tahir Farm	7	21	28
Barami Farm	4	16	20
Galambi Farm	5	11	16
Bishi Farm	8	29	37
Miri Farm	12	28	40
Maikano Farm	14	92	106

Table 3: Sex Distribution of Cattle in 16 Herds in Bauchi (1994).

Farm	Male	Female	Total
University Farm	5	19	24
Fawu Farm	10	34	44
Kobi Farm	12	40	52
Oska Farm	16	40	56
Jumba Farm	12	40	52
Bula Farm	8	31	39
State Poly. Farm	4	22	26
Buba Farm	5	16	21
LIBC	9	27	36
Giwo Farm	9	29	38
Tahir Farm	4	16	20
Barami Farm	-	-	-
Galambi Farm	-	-	-
Bishi Farm	-	-	-
Miri Farm	-	-	-
Maikano Farm	-	-	-

Table 4: Sex Distribution of Cattle in 16 Herds in Bauchi (1995).

Farm	Male	Female	Total
University Farm	5	31	36
Fawu Farm	11	33	44
Kobi Farm	12	40	52
Oska Farm	15	33	48
Jumba Farm	13	37	50
Bula Farm	9	31	40
State Poly. Farm	4	26	30
Buba Farm	-	-	-
LIBC	-	-	-
Giwo Farm	8	26	34
Tahir Farm	7	22	29
Barami Farm	-	-	-
Galambi Farm	-	-	-
Bishi Farm	-	-	-
Miri Farm	-	-	-
Maikano Farm	-	-	106

Table 5: Yearly Incidence of Haemoparasite (Expressed Per 100 Cow-Months).

Farm	1993			1994			1995		
	Cow month	No. +ve	Per 100 cowmonths	Cow month	No. +ve	Per 100 cowmonths	Cow month	No. +ve	Per 100 cowmonths
University	368	30	8.2	519	26	5.0	501	0	0
Fawu	593	27	4.6	566	17	3.0	634	12	1.9
Kobi	785	56	7.1	715	23	3.2	584	27	4.6
Oska	772	32	4.1	704	11	1.6	588	0	0
Jumba	728	48	6.6	678	20	2.9	802	9	1.1
Bula	514	17	3.3	580	4	0.7	530	25	4.7
State Poly	366	14	3.8	419	3	0.7	447	0	0
Buba	393	43	10.9	407	12	2.9	-	-	-
LIBC	541	47	8.7	436	13	3.0	-	-	-
Giwo	515	10	1.9	480	3	0.6	502	2	0.4
Tahir	409	28	6.8	279	0	0	458	2	0.4
Barami	225	0	0	-	-	-	-	-	-
Galambi	206	3	1.5	-	-	-	-	-	-
Bishi	421	4	1.0	-	-	-	-	-	-
Miri	493	8	1.6	-	-	-	-	-	-
Maikano	318	0	0	-	-	-	-	-	-

Table 6: Yearly Incidence of Babesia Infection (Expressed Per 100 Cow-Months).

Farm	1993			1994			1995		
	Cow month	No. +ve	Per 100 cowmonths	Cow month	No. +ve	Per 100 cowmonths	Cow month	No. +ve	Per 100 cowmonths
University	368	5	1.4	519	1	0.2	501	0	0
Fawu	593	4	0.7	566	0	0	634	0	0
Kobi	785	9	1.2	715	3	0.4	584	2	0.3
Oska	772	5	0.7	704	1	0.1	588	0	0
Jumba	728	6	0.8	678	3	0.4	802	0	0
Bula	514	2	0.4	580	0	0	530	2	0.4
State Poly	366	1	0.3	419	0	0	477	0	0
Buba	393	3	0.8	407	0	0	-	-	-
LIBC	541	5	0.9	436	2	0.5	-	-	-
Giwo	515	0	0	480	0	0	502	0	0
Tahir	409	2	0.5	279	0	0	458	0	0
Barami	225	0	0	-	-	-	-	-	-
Galambi	206	0	0	-	-	-	-	-	-
Bishi	421	0	0	-	-	-	-	-	-
Miri	493	1	0.2	-	-	-	-	-	-
Maikano	318	0	0	-	-	-	-	-	-

Table 7: Yearly incidence of Anaplasma Infection (Expressed Per 100 Cow-Months).

Farm	1993			1994			1995		
	Cow month	No. +ve	Per 100 cowmonths	Cow month	No. +ve	Per 100 cowmonths	Cow month	No. +ve	Per 100 cowmonths
University	368	25	6.8	519	25	4.8	501	0	0
Fawu	593	23	3.9	566	17	3.0	634	12	1.9
Kobi	785	45	5.7	715	20	2.8	584	25	4.3
Oska	772	27	3.5	704	10	1.4	588	0	0
Jumba	728	42	5.8	678	17	2.5	802	9	1.1
Bula	514	15	2.9	580	4	0.7	530	23	4.3
State Poly	366	13	3.6	419	3	0.7	447	0	0
Buba	393	40	10.2	407	12	2.9	-	-	-
LIBC	541	42	7.8	436	11	2.5	-	-	-
Giwo	515	10	1.9	480	3	0.6	502	2	0.4
Tahir	409	26	6.4	279	0	0	458	2	0.4
Barami	225	0	0	-	-	-	-	-	-
Galambi	206	3	1.5	-	-	-	-	-	-
Bishi	421	4	1.0	-	-	-	-	-	-
Miri	493	7	1.6	-	-	-	-	-	-
Maikano	318	0	0	-	-	-	-	-	-

Table 8: Yearly Incidence of Helminths (Expressed Per 100 Cow-Months).

Farm	1993			1994			1995		
	Cow month	No. +ve	Per 100 cowmonths	Cow month	No. +ve	Per 100 cowmonths	Cow month	No. +ve	Per 100 cowmonths
University	368	62	16.8	519	33	6.4	501	32	6.4
Fawu	593	75	12.6	566	30	5.3	634	51	8.0
Kobi	785	13.2	16.8	715	54	7.6	584	63	10.8
Oska	772	64	8.3	704	24	3.4	588	17	2.9
Jumba	728	100	13.7	678	52	7.7	802	28	3.5
Bula	514	37	7.2	580	13	2.2	530	22	4.2
State Poly	366	41	11.2	419	24	5.7	447	26	5.8
Buba	393	61	15.5	407	45	11.1	-	-	-
LIBC	541	91	16.8	436	69	15.8	-	-	-
Giwo	515	46	8.9	480	34	7.1	502	24	4.8
Tahir	409	66	16.1	279	19	6.8	458	27	5.9
Barami	225	16	7.1	-	-	-	-	-	-
Galambi	206	15	7.3	-	-	-	-	-	-
Bishi	421	54	12.8	-	-	-	-	-	-
Miri	493	46	9.3	-	-	-	-	-	-
Maikano	318	32	10.1	-	-	-	-	-	-

Table 9: Yearly Incidence of Ectoparasite (Expressed Per 100 Cow-Months).

Farm	1993			1994			1995		
	Cow month	No. +ve	Per 100 cowmonths	Cow month	No. +ve	Per 100 cowmonths	Cow month	No. +ve	Per 100 cowmonths
University	368	149	40.5	519	86	16.6	501	52	10.4
Fawu	593	82	13.8	566	77	13.6	634	53	8.4
Kobi	785	126	16.1	715	73	10.2	584	73	12.5
Oska	772	129	16.7	704	57	8.1	588	22	3.7
Jumba	728	111	15.2	678	122	18.0	802	26	3.2
Bula	514	32	6.2	580	19	3.3	530	59	11.1
State Poly	366	38	10.4	419	35	8.4	447	29	6.5
Buba	393	64	16.3	407	61	15.0	-	-	-
LIBC	541	76	14.0	436	83	19.0	-	-	-
Giwo	515	34	6.6	480	50	10.4	502	30	6.0
Tahir	409	69	16.9	279	23	8.2	458	225	5.5
Barami	225	10	4.4	-	-	-	-	-	-
Galambi	206	11	5.3	-	-	-	-	-	-
Bishi	421	20	4.8	-	-	-	-	-	-
Miri	493	0	0	-	-	-	-	-	-
Maikano	318	13	4.1	-	-	-	-	-	-

Table 10: Prevalence of Tuberculosis and Brucellosis in 16 Herds of Cattle in Bauchi (At the Beginning of the Study).

Farm	Total Number Screened	Tuberculosis (No Positive)*	Brucellosis (No Positive)
University Farm	32	2 (6.3)	2 (6.3)
Fawu Farm	45	0 (0)	2 (4.4)
Kobi Farm	62	0 (0)	5 (8.1)
Oska Farm	61	2 (3.3)	4 (6.6)
Jumba Farm	61	4 (6.6)	6 (9.8)
Bula Farm	60	0 (0)	0 (0)
State Poly Farm	30	2 (6.7)	1 (3.3)
Buba Farm	31	0 (0)	1 (3.2)
Libc	35	0 (0)	0 (0)
Giwo Farm	38	0 (0)	0 (0)
Tahir Farm	28	1 (3.6)	2 (7.1)
Barami Farm	20	0 (0)	1 (5.0)
Galambi Farm	16	0 (0)	0 (0)
Bishi Farm	37	6 (16.2)	4 (10.8)
Miri Farm	40	13 (32.5)	1 (2.5)
Maikano Farm	106	10 (9.4)	3 (2.8)

* Number in Bracket Indicate % Positive.

Table 11: Prevalence of Tuberculosis and Brucellosis in 16 Herds of Cattle in Bauchi (At the End of the Study).

Farm	Total Number Screened	Tuberculosis (No Positive)*	Brucellosis (No Positive)*
University Farm	72	2 (2.8)	0 (0)
Fawu Farm	40	1 (2.5)	0 (0)
Kobi Farm	48	0 (0)	0 (0)
Oska Farm	50	0 (0)	0 (0)
Jumba Farm	72	0 (0)	2 (2.8)
Bula Farm	46	0 (0)	0 (0)
State Poly Farm	20	0 (0)	0 (0)
Buba Farm	-	-	0 (0)
LIBC	-	-	0 (0)
Giwo Farm	15	0 (0)	0 (0)
Tahir Farm	45	0 (0)	3 (6.7)
Barami Farm	-	-	-
Galambi Farm	-	-	-
Bishi Farm	-	-	-
Miri Farm	-	-	-
Maikano Farm	-	-	-

- Withdrew from the Study

* Number in Bracket Indicate % Positive.

Table 12: Incidence of Culling for Various Farms in Bauchi 1993 - 95 (Expressed in Cow-Months).

Farm	Total Number of Cow Months	Number Culled	Percent Culled
University Farm	1762	13	0.7
Fawu Farm	2135	12	0.6
Kobi Farm	2186	28	1.3
Oska Farm	1919	26	1.4
Jumba Farm	2538	37	1.5
Bula Farm	1639	18	1.1
State Poly. Farm	968	5	0.5
Buba Farm	740	5	0.7
LIBC	747	1	0.1
Giwo Farm	1273	5	0.4
Tahir Farm	1661	21	1.3
Barami Farm	136	1	0.7
Galambi Farm	184	2	1.1
Bishi Farm	389	3	0.8
Miri Farm	399	2	0.5
Maikano Farm	318	6	1.9

Table 13: Causes of Culling in 16 Herds in Bauchi (1993 - 95).

Cause	Number Culled	Percent of Number Culled
Dermatophilosis	120	64.9
Old Age	30	16.2
Reproductive Failure	3	1.6
Malnutrition	10	5.4
Others	22	11.9

Table 14: Incidence of Culling for Dermatophilosis for Various Farm in Bauchi 1993-95 (Expressed Per 100 Cow-Months).

Farm	Total Number of Cow Months	Number Culled	Percent Culled
University Farm	1762	9	0.5
Fawu Farm	2135	7	0.3
Kobi Farm	2186	18	0.8
Oska Farm	1919	16	0.8
Jumba Farm	2538	27	1.1
Bula Farm	1639	13	0.8
State Poly. Farm	968	4	0.4
Buba Farm	740	4	0.5
LIBC	747	1	0.3
Giwo Farm	1273	3	0.2
Tahir Farm	1661	14	0.8
Barami Farm	136	0	0
Galambi Farm	184	0	0
Bishi Farm	389	2	0.5
Miri Farm	399	0	0
Maikano Farm	318	2	0.6

Table 15: **Incidence of Mortality of Cattle in 16 Herds (1993-1995) Expressed per 100 Cow Months.**

Farm	Total Number of Cow Months	Mortality	Percent Mortality
University Farm	1916	22	1.2
Fawu Farm	2308	15	0.6
Kobi Farm	2276	47	2.1
Oska Farm	2376	48	2.0
Jumba Farm	3312	50	1.5
Bula Farm	2128	33	1.6
State Poly. Farm	1616	10	0.6
Buba Farm	973	10	1.0
LIBC	1001	9	0.9
Giwo Farm	1819	19	1.0
Tahir Farm	1704	29	1.7
Barami Farm	225	4	1.8
Galambi Farm	206	2	1.0
Bishi Farm	421	5	1.2
Miri Farm	493	6	1.2
Maikano Farm	318	6	1.9

Table 16: Incidence of Mortality of Adult Cattle in 16 Herds in Bauchi (1993-95) Expressed Per 100 Cow-Months.

Farm	Total Number of Cow Months	Mortality	Percent Mortality
University Farm	1762	5	0.3
Fawu Farm	2135	3	0.1
Kobi Farm	2186	10	0.5
Oska Farm	1919	8	0.4
Jumba Farm	2538	1	0.04
Bula Farm	1639	5	0.3
State Poly. Farm	968	1	0.1
Buba Farm	740	3	0.4
LIBC	747	5	0.7
Giwo Farm	1273	4	0.3
Tahir Farm	1661	2	0.1
Barami Farm	136	1	0.7
Galambi Farm	184	0	0
Bishi Farm	389	1	0.3
Miri Farm	399	1	0.3
Maikano Farm	318	0	0

TABLE 17: Incidence of Mortality of Calves in 16 Herds in Bauchi (1993-1995)
Expressed Per 100 Cow-Months

Farm	Total Number of Calf Months	Mortality	Percent Mortality
University Farm	507	9	1.8
Fawu Farm	486	3	0.6
Kobi Farm	1068	19	1.8
Oska Farm	852	22	2.6
Jumba Farm	986	13	1.3
Bula Farm	787	15	1.9
State Poly. Farm	728	5	0.7
Buba Farm	436	5	1.2
LIBC	300	8	2.7
Giwo Farm	776	14	1.8
Tahir Farm	397	8	2.0
Barami Farm	91	3	3.3
Galambi Farm	22	0	0
Bishi Farm	58	2	3.5
Miri Farm	168	4	2.4
Maikano Farm	120	0	0

Table 18: Yearly Calf Mortality Rates For the 16 Herds in Bauchi.

Farm	1993			1994			1995			
	No.Born Alive	No. Dead	% Mortality	No.Born Alive	No. Dead	% Mortality	No.Born Alive	No. Dead	% Mortality	Overall % Mortality
University Farm	6	3	50.0	8	3	37.5	11	3	27.3	36.0
Fawu Farm	3	1	33.3	4	1	25.0	6	1	16.7	23.1
Kobi Farm	11	8	72.7	7	4	57.1	12	7	58.3	63.3
Oska Farm	5	5	100	10	9	90.0	13	8	61.5	78.6
Jumba Farm	7	3	42.9	19	8	42.1	10	2	20.0	36.1
Bula Farm	7	4	57.1	10	5	50.0	17	6	35.3	44.1
State Poly. Farm	6	2	33.3	4	1	25.0	6	2	33.3	31.3
Buba Farm	9	5	55.6	37	0	0.0	-	-	-	41.7
LIBC	12	5	41.7	6	3	50.0	-	-	-	42.1
Giwo Farm	7	5	71.4	9	5	55.6	8	4	50.0	58.3
Tahir Farm	9	7	77.8	6	0	0.0	4	1	25.0	42.1
Barami Farm	3	3	100.0	-	-	-	-	-	-	100
Galambi Farm	1	0	0.0	-	-	-	-	-	-	0.0
Bishi Farm	4	2	50.0	-	-	-	-	-	-	50.0
Miri Farm	8	4	50.0	-	-	-	-	-	-	50.0
Maikano Farm	5	0	0.0	-	-	-	-	-	-	0.0

Table 19: Calf Mortality By Ages of Calves (1993-95).

Month	Number Dead	Percentage of Total Dead
0-1	45	34.6
1-2	31	23.8
>2-3	11	8.5
>3-4	7	5.4
>4-5	6	4.6
>5-6	6	4.6
>6-7	5	3.8
>7-8	5	3.8
>8-9	3	2.3
>9-10	6	4.6
>10-11	3	2.3
>11-12	2	1.5

Table 20: Life Table of Survival of Calves in 16 Herds in Bauchi (1993-95).

X	O_x	n^d_x	n^q_x	n^p_x	P_x
>0-1	227	45	0.162	0.838	1.000
>1-2	232	31	0.134	0.866	0.838
>2-3	201	11	0.055	0.945	0.726
>3-4	190	7	0.037	0.963	0.686
>4-5	183	6	0.033	0.967	0.661
>5-6	177	6	0.034	0.966	0.639
>6-7	171	5	0.030	0.970	0.599
>7-8	166	5	0.030	0.970	0.599
>8-9	161	3	0.019	0.981	0.581
>9-10	158	6	0.038	0.962	0.570
>10-11	152	3	0.019	0.981	0.548
>11-12	149	2	0.013	0.987	0.538

X Time Range in months following birth.

O_x Number of Calves alive at least X months after birth.

n^d_x Number of Calves dying between the X^{th} and the X^{th} + 1 month.

n^q_x Probability of dying during the X^{th} to the X^{th} + 1 month for those alive at time X

n^p_x Probability of those Calves alive at the time X surviving until the Xth + 1 month. Thus $n^p_x = 1 - n^q_x$

P_x The proportion of Calves surviving X months

Table 21: Life Table of Survival of Calves in 16 Herds in Bauchi (1993).

X	O_x	n^d_x	n^q_x	n^p_x	P_x
>0-1	103	20	0.194	0.806	1.000
>1-2	83	11	0.133	0.867	0.806
>2-3	72	5	0.069	0.931	0.699
>3-4	67	4	0.060	0.940	0.651
>4-5	63	3	0.048	0.952	0.612
>5-6	60	3	0.050	0.950	0.583
>6-7	57	3	0.053	0.947	0.554
>7-8	54	3	0.056	0.944	0.525
>8-9	51	3	0.059	0.941	0.496
>9-10	48	1	0.021	0.979	0.467
>10-11	47	1	0.021	0.979	0.457
>11-12	46	0	0.000	1.000	0.447

X Time Range in months following birth.

O_x Number of Calves alive at least X months after birth.

n^d_x Number of Calves dying between the X^{th} and the X^{th} + 1 month.

n^q_x Probability of dying during the X^{th} to the X^{th} + 1 month for those alive at time X

n^p_x Probability of those Calves alive at the time X surviving until the Xth + 1 month. Thus $n^p_x = 1 - n^q_x$

P_x The proportion of Calves surviving X months

Table 22: Life Table of Survival of Calves in 11 Herds in Bauchi (1994).

X	O_x	n^d_x	n^q_x	n^p_x	P_x
>0-1	86	15	0.174	0.826	1.000
>1-2	71	11	0.155	0.845	0.826
>2-3	60	3	0.050	0.950	0.698
>3-4	57	2	0.035	0.965	0.663
>4-5	55	2	0.036	0.964	0.639
>5-6	53	2	0.038	0.962	0.616
>6-7	51	2	0.039	0.961	0.593
>7-8	49	2	0.041	0.959	0.569
>8-9	49	0	0.000	1.000	0.546
>9-10	49	0	0.000	1.000	0.546
>10-11	49	0	0.000	1.000	0.546
>11-12	49	0	0.000	1.000	0.546

X Time Range in months following birth.

O_x Number of Calves alive at least X months after birth.

n^d_x Number of Calves dying between the X^{th} and the X^{th} + 1 month.

n^q_x Probability of dying during the X^{th} to the X^{th} + 1 month for those alive at time X

n^p_x Probability of those Calves alive at the time X surviving until the Xth + 1 month. Thus $n^p_x = 1 - n^q_x$

P_x The proportion of Calves surviving X months

Table 23: Life Table of Survival of Calves in 9 Herds in Bauchi (1995).

X	O_x	n^d_x	n^q_x	n^p_x	P_x
>0-1	87	10	0.115	0.885	1.000
>1-2	77	9	0.117	0.883	0.885
>2-3	68	3	0.044	0.956	0.781
>3-4	65	1	0.015	0.985	0.747
>4-5	64	1	0.016	0.984	0.736
>5-6	63	1	0.019	0.981	0.724
>6-7	62	0	0.000	1.000	0.710
>7-8	62	0	0.000	1.000	0.710
>8-9	62	0	0.000	1.000	0.710
>9-10	57	5	0.088	0.912	0.710
>10-11	55	2	0.036	0.964	0.648
>11-12	53	2	0.038	0.962	0.625

X Time Range in months following birth.

O_x Number of Calves alive at least X months after birth.

n^d_x Number of Calves dying between the X^{th} and the X^{th} + 1 month.

n^q_x Probability of dying during the X^{th} to the X^{th} + 1 month for those alive at time X

n^p_x Probability of those Calves alive at the time X surviving until the Xth + 1 month. Thus $n^p_x = 1 - n^q_x$

P_x The proportion of Calves surviving X months

Table 24: Cause Associated Case-Fatality Rates for Adult Cattle in Selected Herds in Bauchi (1993-95).

Condition	Total Number With Condition	Number Dead Due to Condition	Case Fatality Rate (%)
CBPP	54	6	11.1
Dermatophilosis	88	5	5.7
Foot-Rot	74	1	1.4
Conjunctivitis	323	0	0
Pneumonia	526	10	1.9
Mastitis	53	0	0
Retained Placenta	30	0	0
Metritis	9	1	11.1
FMD	21	3	14.3
Coccidiosis	8	1	12.5
Poisoning	48	9	18.8
Bloat	90	3	3.3
Diarrhoea	416	2	0.5
Gastroenteritis	104	3	2.9
Snake Bite	19	0	0
Septicemia	15	2	13.3
Trauma	112	4	3.6

Table 25: Cause Associated Case-Fatality Rates for Calves in *Selected Herds in Bauchi* (1993-95).

Condition	Total Number With Condition	Number Dead Due to Condition	Case Fatality Rate (%)
Gastroenteritis	25	7	28.0
Calf Scour	202	48	23.8
Septicemia	40	20	50.0
Conjunctivitis	18	1	5.6
Pneumonia	117	32	27.4
Coccidiosis	17	6	35.3
Snake Bite	69	2	33.3
Malnutrition	19	7	36.8
Injury	17	7	41.2

Table 26: Distribution of Parity Relative to Age of Cows in 16 Herds in Bauchi.

	Parity						
Age (Years)	0	1	2	3	4	5	Total
3	72	2	0	0	0	0	74
4	35	23	0	0	0	0	58
5	19	53	4	0	0	0	76
6	9	37	24	0	0	0	70
7	2	13	23	6	0	0	44
8	1	0	17	15	0	0	33
9	0	0	7	7	1	0	15
10	0	0	0	0	1	0	1
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13-17	0	0	0	0	0	0	0
Total	138	128	75	28	2	0	-
% Total	37.2	34.5	20.2	7.6	0.5	0	-

Table 27: Year Calvings Based on Selected Farms in Bauchi.

Farm	1993	1994	1995
University Farm	6	8	11
Fawu Farm	4	4	5
Kobi Farm	11	7	12
Oska Farm	5	10	13
Jumba Farm	7	19	10
Bula Farm	7	10	17
State Poly. Farm	6	4	6
Buba Farm	9	3	0
LIBC	12	6	0
Giwo Farm	7	9	8
Tahir Farm	9	6	4
Barami Farm	-	-	-
Galambi Farm	-	-	-
Bishi Farm	-	-	-
Miri Farm	-	-	-
Maikano Farm	-	-	-

Table 28: Yearly Calving Rates in Selected Herds in Bauchi.

Farm	1993	1994	1995
University Farm	40	61.5	47.8
Fawu Farm	14.8	18.2	25
Kobi Farm	34.4	19.4	37.5
Oska Farm	17.2	31.3	59.1
Jumba Farm	18.9	65.5	40
Bula Farm	29	37	56.7
State Poly. Farm	40	40	40
Buba Farm	69	27	0
LIBC	85.7	42.9	0
Giwo Farm	43	45	42.1
Tahir Farm	52.9	54.6	23.5
Barami Farm	-	-	-
Galambi Farm	-	-	-
Bishi Farm	-	-	-
Miri Farm	-	-	-
Maikano Farm	-	-	-

Table 30: Distribution of Calving Intervals in Some Herds in Bauchi (1993-95).

	Calving Interval in Months							
Farm	**9-11**	**12-13**	**14-15**	**16-17**	**18-19**	**20-21**	**22-23**	**>24**
University Farm	0	0	2	3	0	2	2	2
Fawu Farm	0	0	2	2	1	0	3	5
Kobi Farm	0	2	4	1	1	2	1	1
Oska Farm	0	2	3	1	1	2	1	2
Jumba Farm	0	3	3	2	3	2	5	5
Bula Farm	1	4	5	1	1	1	0	0
State Poly. Farm	0	1	1	2	0	1	2	2
Buba Farm	0	0	0	0	0	0	0	0
LIBC	0	1	1	0	0	0	0	0
Giwo Farm	0	1	2	0	2	1	1	2
Tahir Farm	0	1	1	0	2	2	0	0
Barami Farm	-	-	-	-	-	-	-	-
Galambi Farm	-	-	-	-	-	-	-	-
Bishi Farm	-	-	-	-	-	-	-	-
Miri Farm	-	-	-	-	-	-	-	-
Maikano Farm	-	-	-	-	-	-	-	-

Table 31: Relationship Between Ectoparasites Infection and Cycling (1993-95).

	1993		1994		1995	
Farm	X^{2*}	%	X^{2*}	%	X^{2*}	%
University	2.7*	35.9	0.1	22.1	1.4	31.2
Fawu	0.1	15.6	0.1	10.0	0.3	18.2
Kobi	1.0	18.2	0.9	21.9	0.6	22.2
Oska	0.5	29.0	1.9	17.9	0.7	10.0
Jumba	0.1	17.7	0.0	22.8	0.0	23.1
Bula	0.0	23.0	0.4	20.0	0.3	27.6
State Poly.	0.2	22.2	0.5	23.5	0.0	22.7
Buba	0.4	25.8	3.1*	18.2	--	--
LIBC	0.6	32.5	0.2	26.4	--	--
Giwo	0.1	22.9	1.8	30.8	0.5	15.6
Tahir	2.5	15.6	0.8	26.1	2.0	8.0

KEY:

X^2 = Chisquare Value at 1 degree of freedom

% = Percent infested that are cycling

* =Not significant

Table 32: Relationship Between Endoparasite (Strongyle) Infestation and Cycling (1993-95).

	1993		1994		1995	
Farm	X^{2*}	%	X^{2*}	%	X^{2*}	%
University	2.0	30.4	0.6	28.0	1.3	40.6
Fawu	0.5	25.6	0.3	22.5	0.5	29.0
Kobi	1.8	25.6	1.7	30.2	1.4	27.1
Oska	0.5	34.6	1.6	37.5	0.8	37.5
Jumba	1.5	24.7	0.7	26.5	4.8	39.3
Bula	0.6	30.6	1.0	38.5	1.0	14.3
State Poly.	0.7	27.8	0.1	28.0	1.3	32.0
Buba	0.9	21.1	1.3*	20.0	--	--
LIBC	0.5	32.6	0.4	29.9	--	--
Giwo	0.2	25.6	2.0	35.7	1.3	42.5
Tahir	1.5	24.5	0.9	40.0	3.3	12.5

KEY:

X^2 = Chisquare Value at 1 degree of freedom

% = Percent infested that are cycling

* =Not significant

Table 33: Relationship Between Cycling and Condition Scoring (Nutrition) (1993-95).

	1993	1994	1995
Farm	**X^2**	**X^2**	**X^2**
University	2.8	1.1	0.6
Fawu	1.0	6.7*	3.2
Kobi	30.8	69.6*	20.9*
Oska	63.5*	10.5*	1.2
Jumba	3.4	4.2*	8.0*
Bula	3.1	1.0	2.7
State Poly.	6.6*	4.4*	5.3*
Buba	4.1*	0.6	--
LIBC	0.9	0.6	--
Giwo	3.3	3.8*	3.4
Tahir	5.0*	1.5	3.7

KEY:

X^2 = Chisquare Value at 1 **degree of freedom**

* = Significant at p=0.05

Table 34: Relation Between Cycling and Pregnancy (1993-95).

	X^2 at 1 df		
Farm	**1993**	**1994**	**1995**
University	63.9*	120.8*	97.9*
Fawu	95.3*	71.6*	65.2*
Kobi	84.9*	150.6*	175.8*
Oska	65.2*	211.9*	153.4*
Jumba	609.0*	354.9*	255.7*
Bula	143.9*	326.4*	364.3*
State Poly.	244.4*	126.9*	264.9*
Buba	214.7*	113.1*	--
LIBC	387.8*	225.4*	--
Giwo	48.9*	96.5*	74.2*
Tahir	97.8*	71.6*	189.1*

KEY:

X^2 = Chisquare Value at 1 degree of freedom

* = Significant at p=0.05

Table 35: Local Indication of Some Nigeria Medical Plants.

Hausa Name	Scientific Name	Indications (Local)
Gwandan Daji	*Anona senegalis*	Diarrhoea, Fever, Headaches
Kimba	*X. aethiopica*	Diarrhoea
Duman Dutse	*Aristolochia albida.*	Fever, Diarrhoea
Fasa Kumburi	*Portulaca oleracea.*	Boils, Fever
Marke	*Anogeeissus schimperi*	Fever, Diarrhoea, Dysentry, Dressings
Sabara	*Guiera senegalensis*	Enteric Conditions
Kerana	*Euphobia kamerunica.*	Fever
Gwaiwan Kare	*Fluggea virosa*	Fever, Diarrhoea, Boils
Kalgo	*Bauhinia thonningii*	Diarrhoea,Fever
Rumfu	*Cassia goratensis.*	Clotting agent, Fever, Worms
Taura	*Detarium senegalensis*	Fever, Worms, Enteric Conditions
Gawo	*Accaciaalbida*	Enteric Conditions
Dundu	*Dichrostachys glomerata*	Skin Cond., Fever, Diarrhoea

Table 36: Antiviral Properties of Some Nigeria Plants Used Traditionally in the Treatment of Diarrheoic Conditions in Livestock.

Plant	part Used	Toxicity	Action on Virus (Polio)	Action on Virus (Astro)	Conc. Used
Khanya senegalensis (Madachi)	Bark	None	Kill Virus	Kill Virus	1:10
Dichrostachys glomerata (Dundu)	Leaf	None	Kill Virus	Kill Virus	1:10
Boswelia dalzelii (Hararrabi)	Bark	None	Kill Virus	Kill Virus	1:10
Xylopia aethiopica (Kimba)	Whole Plant	None	Kill Virus	Kill Virus	1:10
Butryospernum parkii (Kadanya)	Bark	None	Kill Virus	Kill Virus	1:10
Anona senegalensis (Gwandan Daji)	Leaf	Toxic	Virus Alive	Virus Alive	1:10
Acacia albida (Gawo)	Bark	Toxic	Virus Alive	Virus Alive	1:10
Euphobia kamerunica (Kerana)	Whole Plant	Toxic	Kill Virus	Kill Viru	1:10
Hyptis pectinata (Kimba-Kimba)	Whole Plant	None	Kill Virus	Kill Virus	1:10

Table 37: Antibacterial Properties of Some Nigerian Medicinal Plants Used in Traditional Medicine.

Plants	E. coli	Ox Staphylococcus aureus	Enterobacter species	Streptococcus pneumonia	Corynebacterium pyogenes	Enterococcus faecalis	Multiresistance Staphylococcus areus	Acenotobacter speciess	Pseudomonas auregenasa	Multiresistance pseudomonas Auregenosa
Khanya senegalensis	6mm	12mm	6mm	6mm	6mm	6mm	6mm	6mm	6mm	6mm
Casia goratensis	6mm	6mm	6mm	6mm	6mm	6mm	6mm	6mm	6mm	6mm
Boswelia dalzelii	6mm	10mm	6mm	6mm	12mm	6mm	6mm	8mm	6mm	6mm
Bauhinia thonningi	10mm	8mm	6mm	6mm	6mm	6mm	8mm	8mm	6mm	6mm
Butryospernum parkii	10mm	12mm	8mm	6mm	6mm	8mm	6mm	6mm	6mm	6mm
Gulera senegalensi	6mm	10mm	6mm	6mm	16mm	10mm	6mm	6mm	6mm	6mm
Anogeeissu schimperi	16mm	20m	16mm	18mm	16mm	16mm	20mm	16mm	16mm	22mm
Anacardium occidentale	8mm	12mm	10mm	12mm	10mm	8mm	12mm	8mm	8mm	10mm

Pore Diameter = 6mm

Measurement greater than 6mm shows some activity

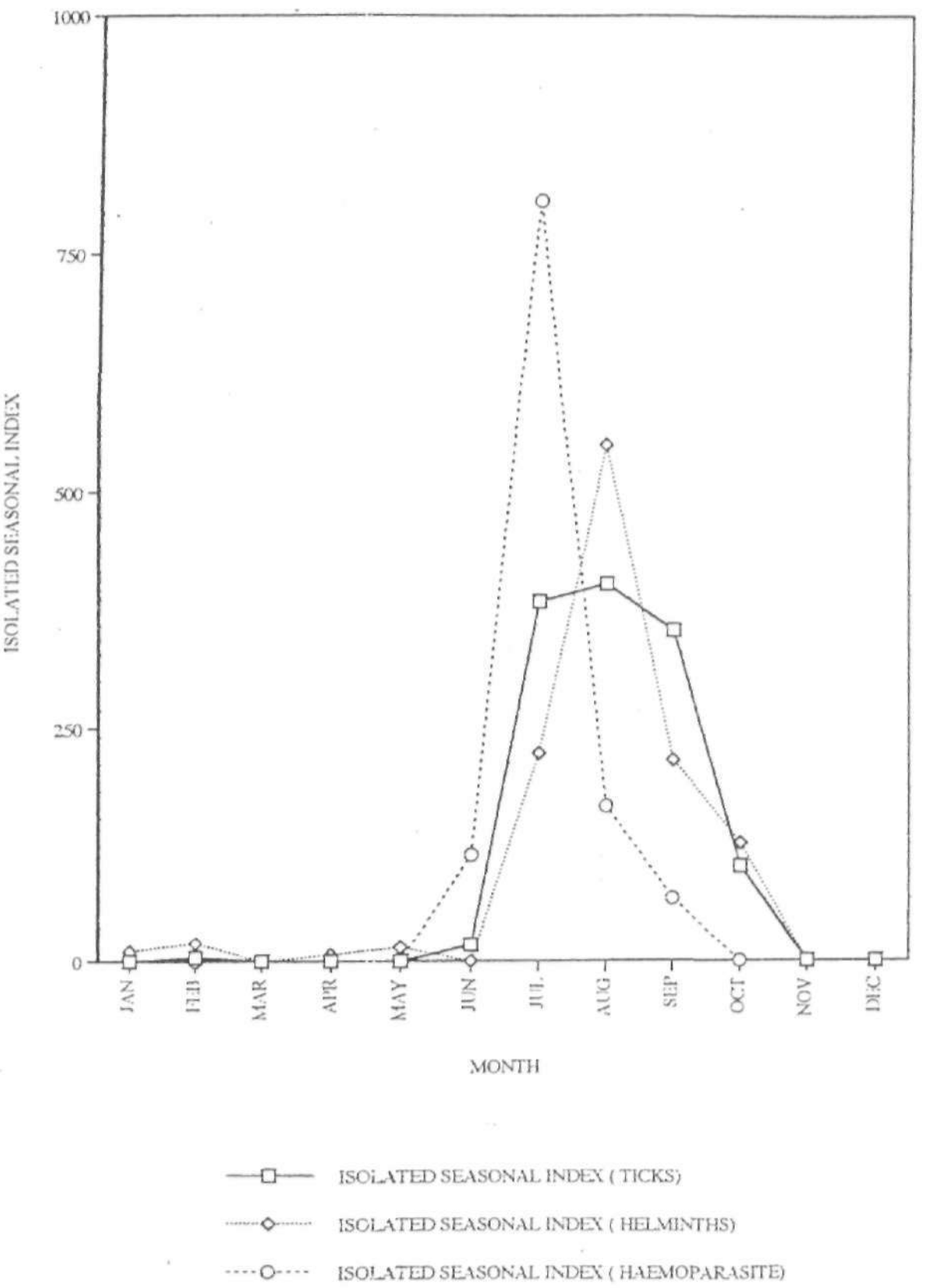


Fig 1: Seasonal Distribution of Parasite in 16 Herds in Bauchi (1993–95).

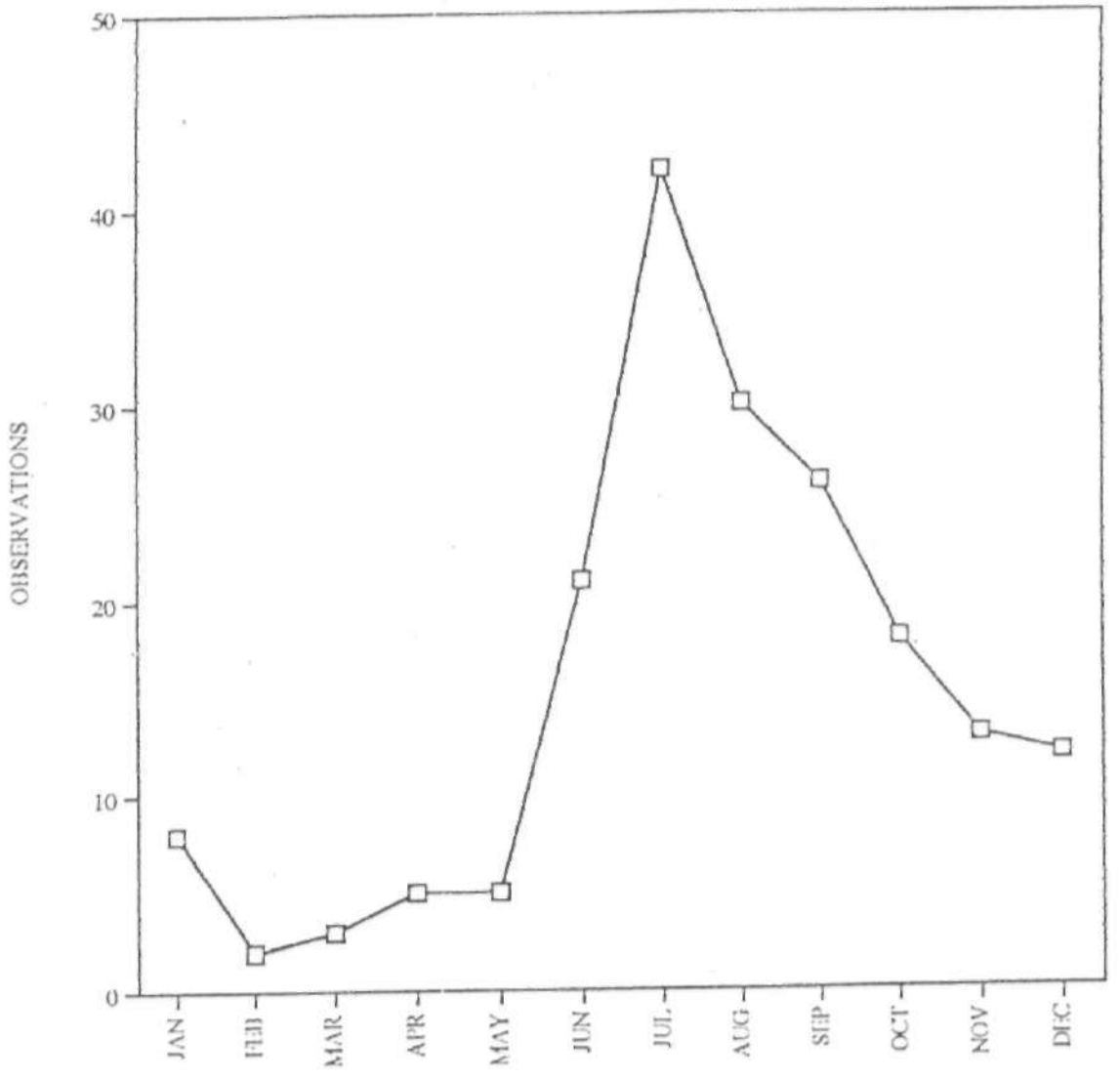


Fig 2: Incidence of Culling By Season for the 16 Herds In Bauchi (1993–95).

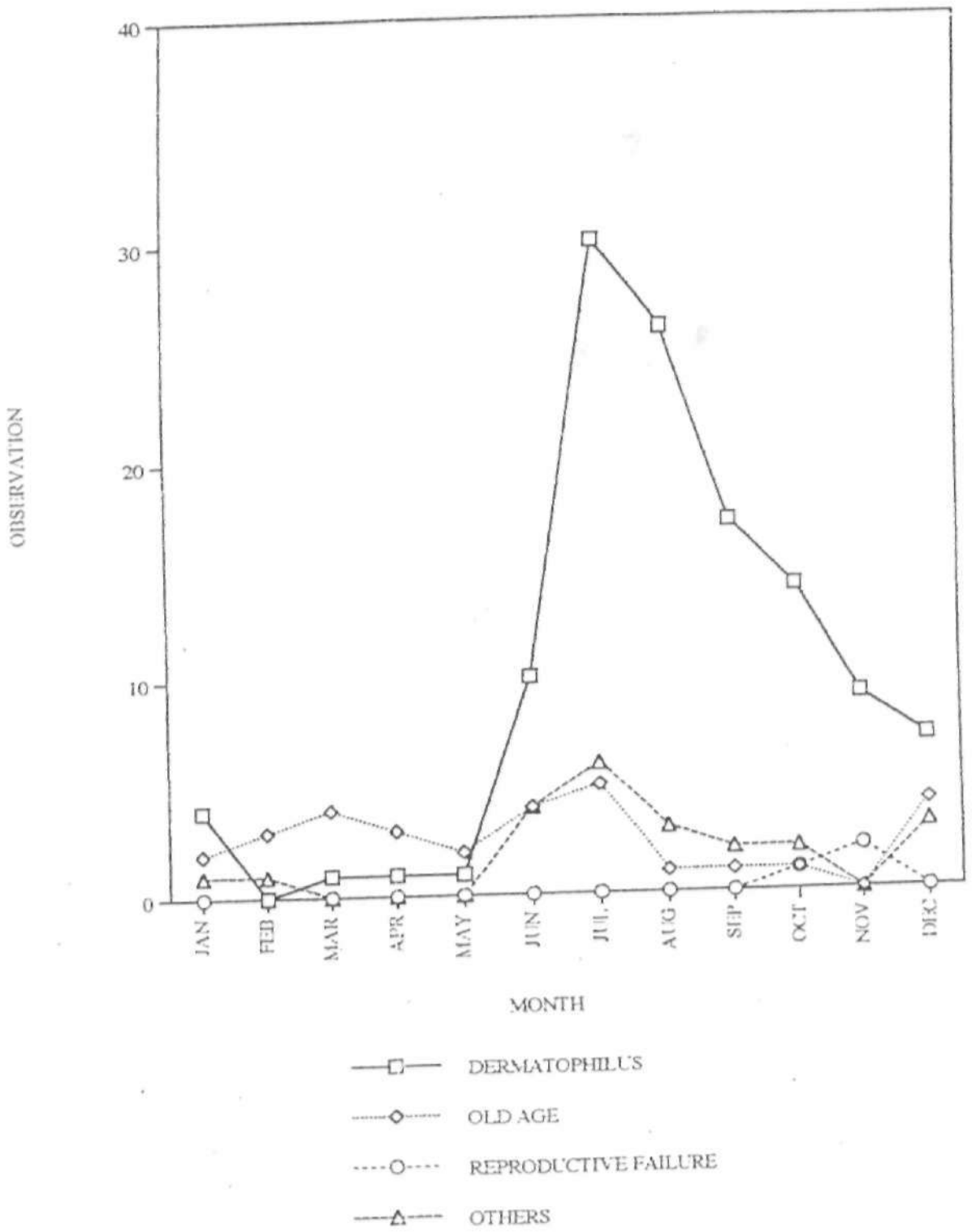
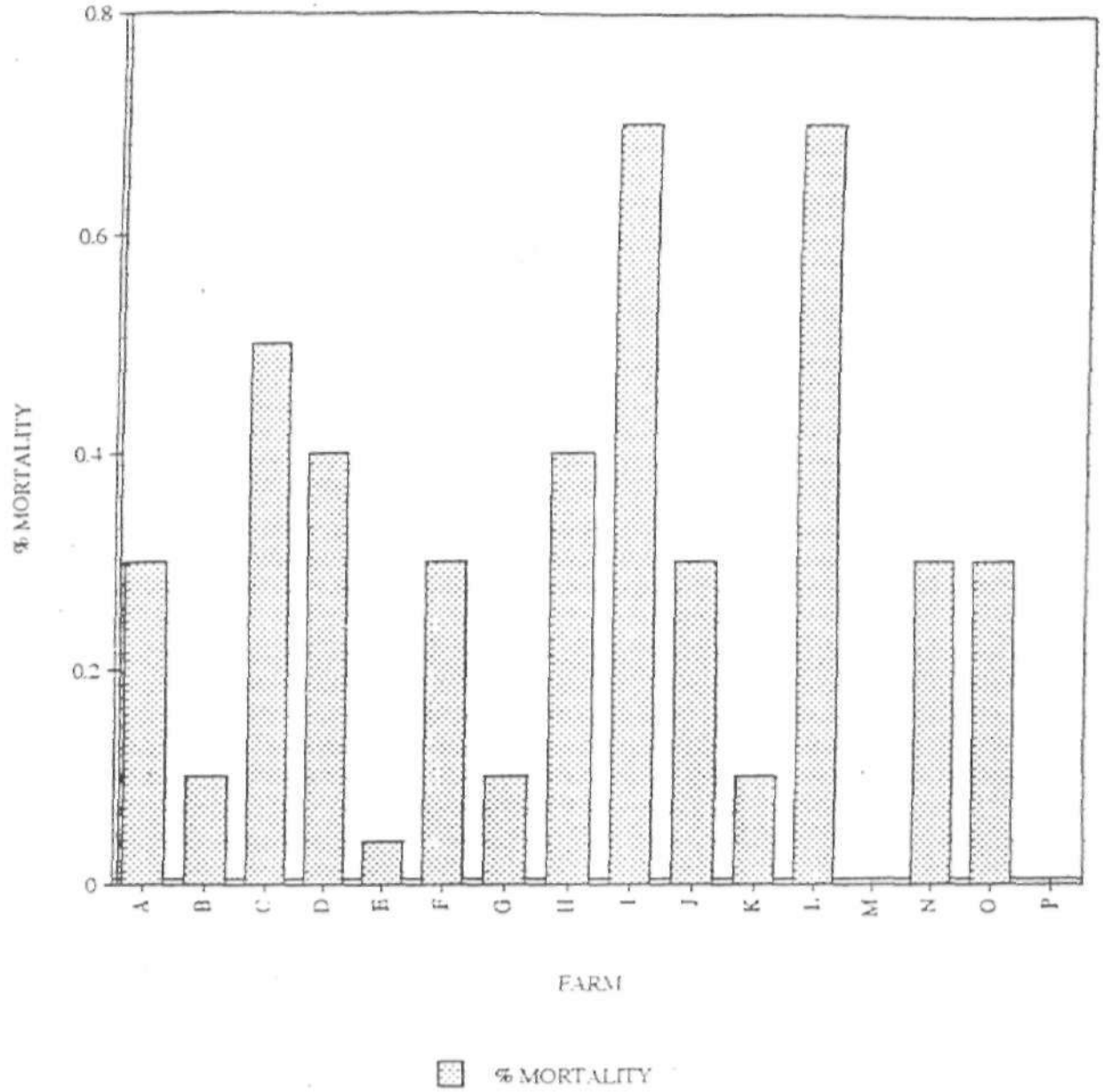


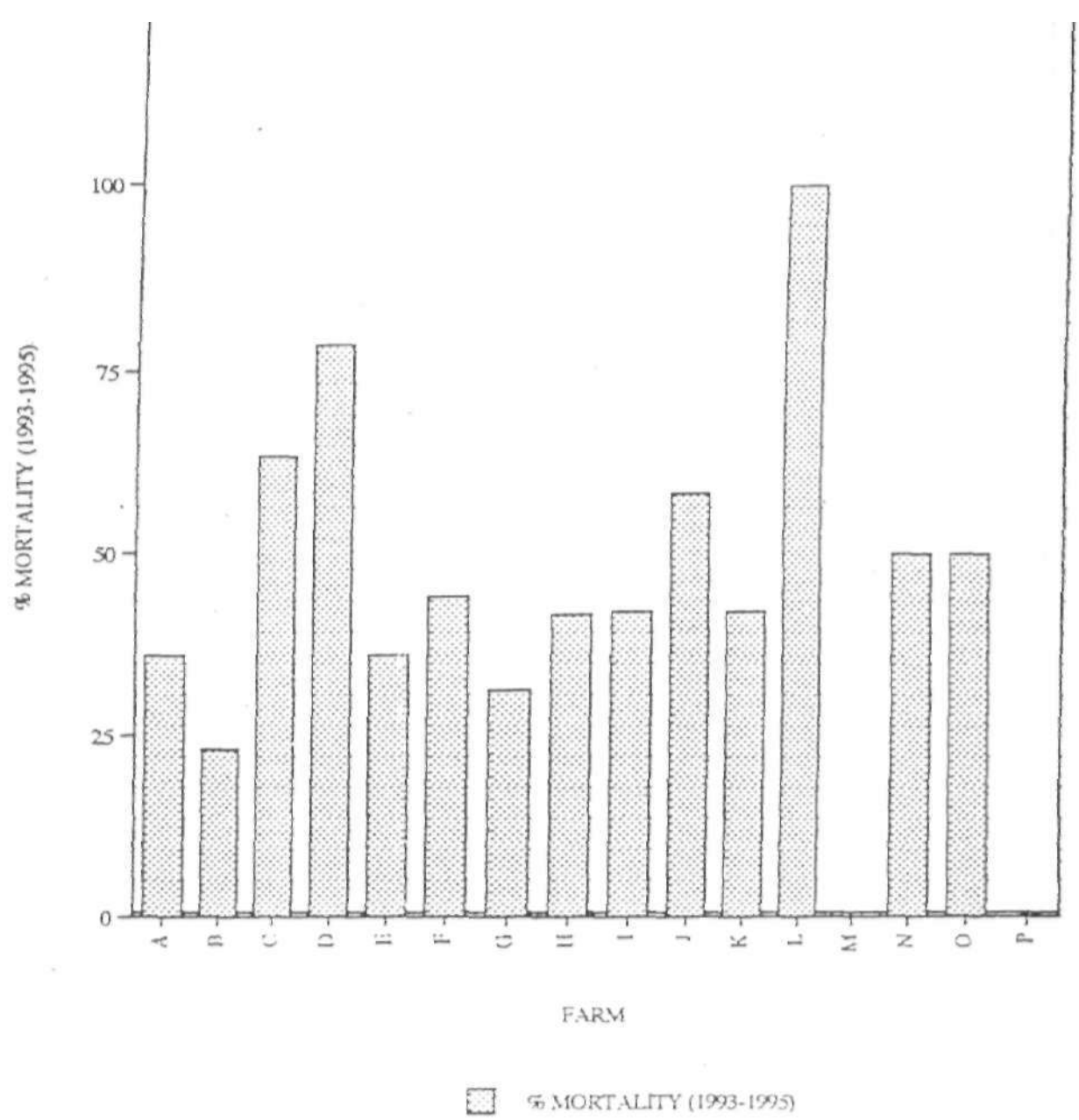
Fig 3: Causes of Culling By Season for the 16 Herds in Bauchi (1993–95).



KEY:

A-University Farm
B-Fawu Farm
C-Kobi Farm
D-Oska Farm
E-Jumba Farm
F-Bula Farm
G-State Poly. Farm
H-Buba Farm
I- LIBC Farm
J-Giwo Farm
K-Tahir Farm
L-Barami Farm
M-Galambi Farm
N-Bishi Farm
O-Miri Farm
P-Maikano Farm

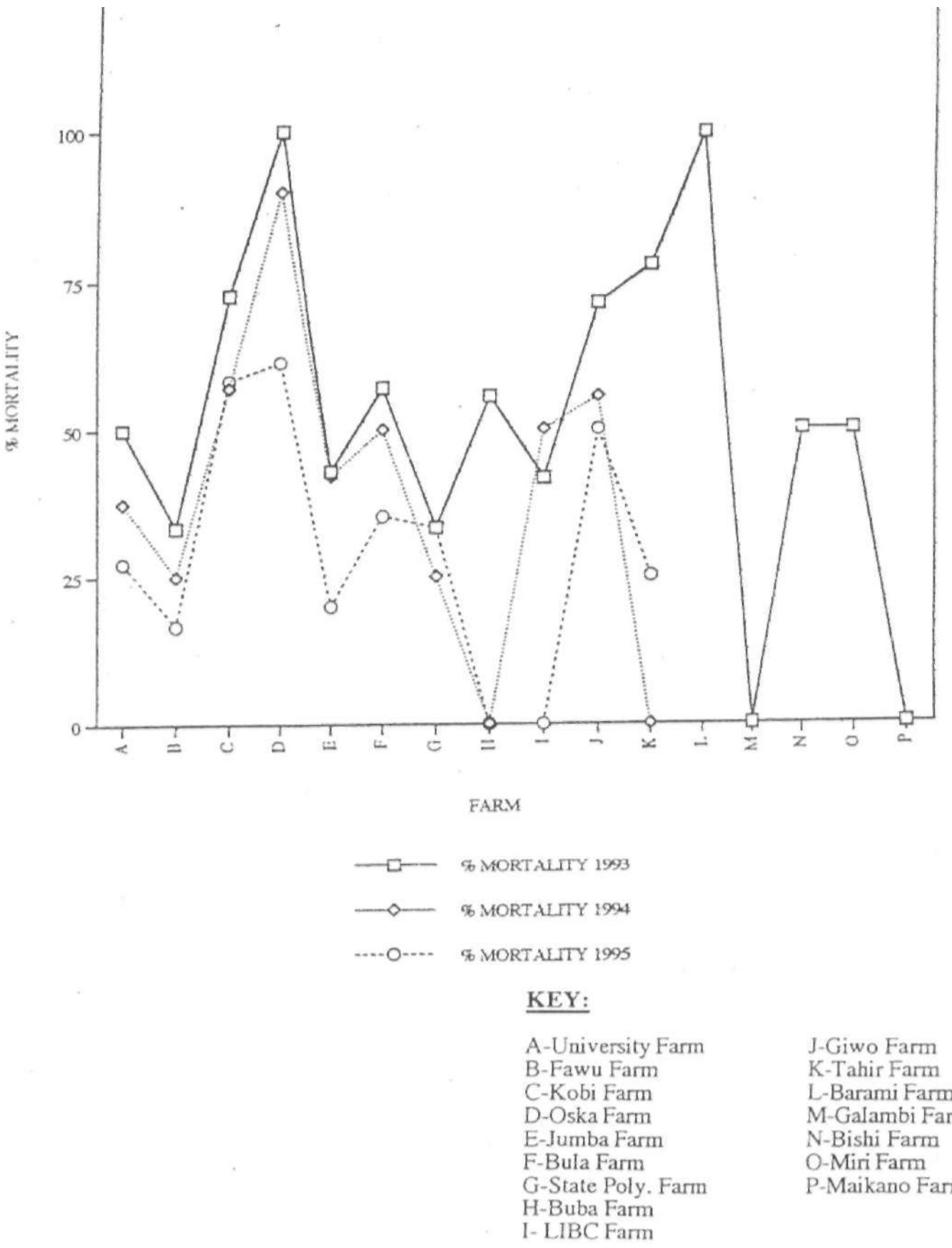
Fig 4: Mortality Rates of Adults Cattle in 16 Herds (1993–95).



KEY:

A-University Farm
B-Fawu Farm
C-Kobi Farm
D-Oska Farm
E-Jumba Farm
F-Bula Farm
G-State Poly. Farm
H-Buba Farm
I- LIBC Farm
J-Giwo Farm
K-Tahir Farm
L-Barami Farm
M-Galambi Farm
N-Bishi Farm
O-Miri Farm
P-Maikano Farm

Fig 5: Calf Mortality rates for 16 Herds in Bauchi.



KEY:

A-University Farm
B-Fawu Farm
C-Kobi Farm
D-Oska Farm
E-Jumba Farm
F-Bula Farm
G-State Poly. Farm
H-Buba Farm
I- LIBC Farm
J-Giwo Farm
K-Tahir Farm
L-Barami Farm
M-Galambi Farm
N-Bishi Farm
O-Miri Farm
P-Maikano Farm

Fig 6: Yearly Calf Mortality Rates for 16 herds in Bauchi.

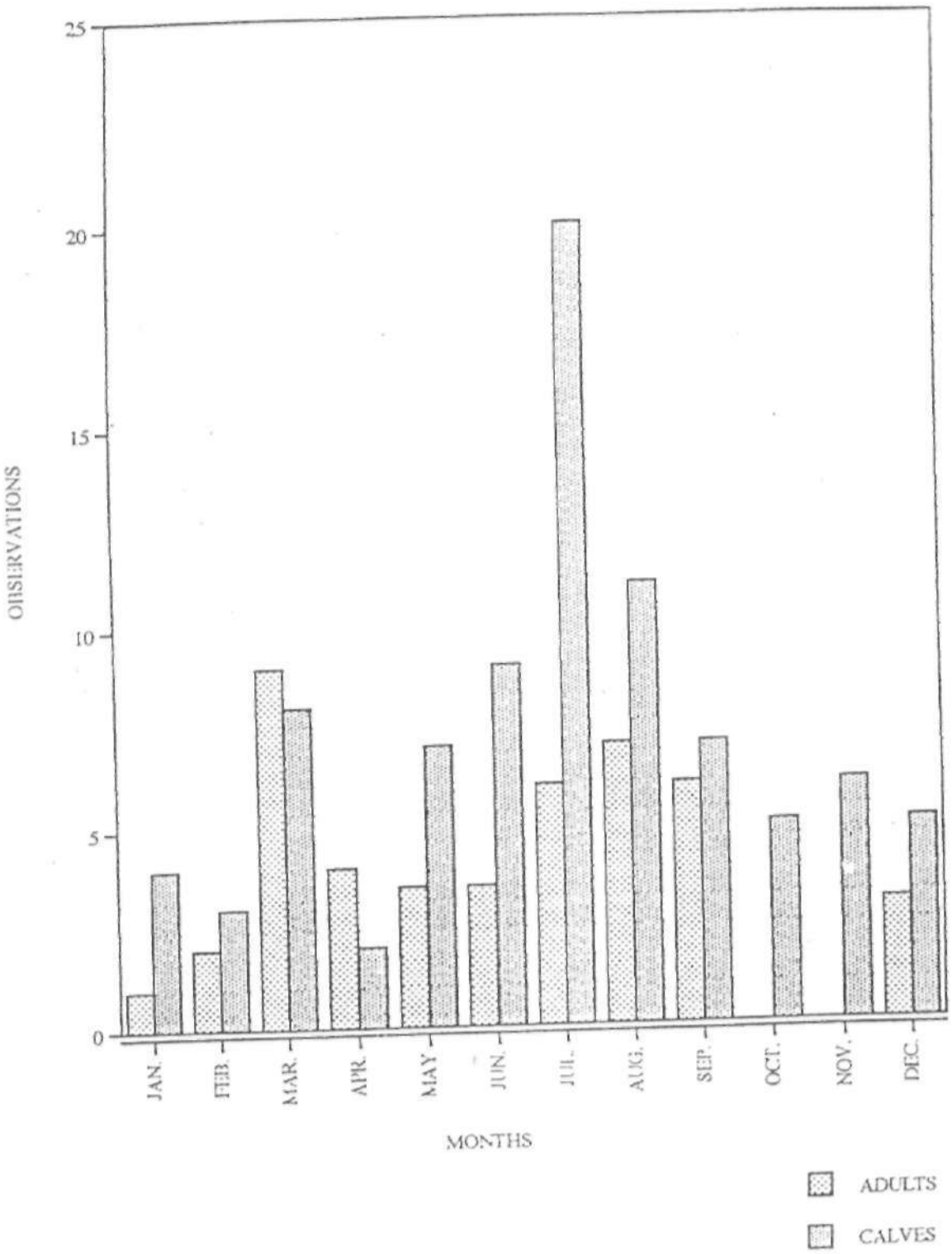


Fig 7: Monthly Mortality Rates of Adults and Calves in Herds Under Study in Bauchi (1993–95).

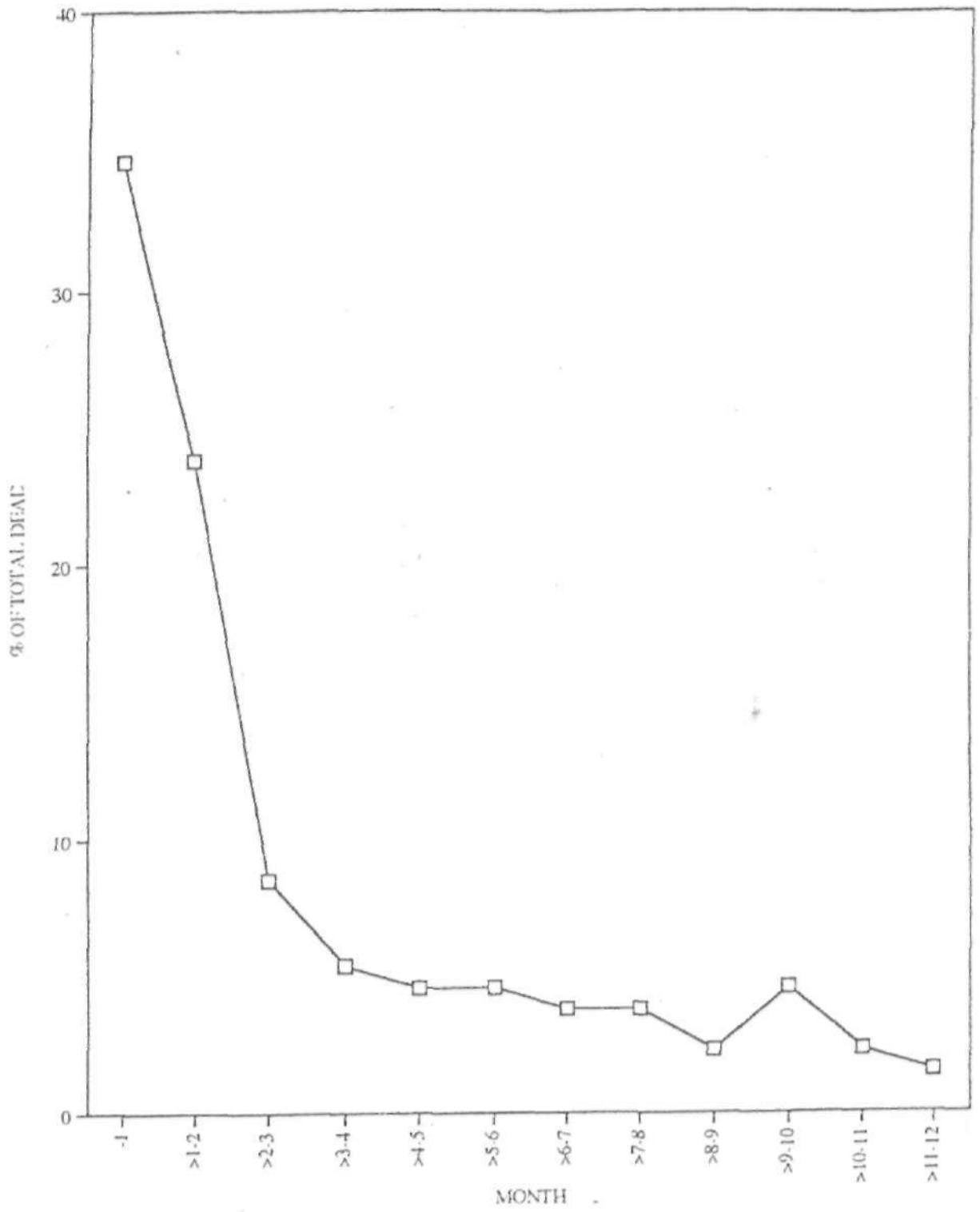


Fig 8: Calf Mortality By Age of Calves (1993–95).

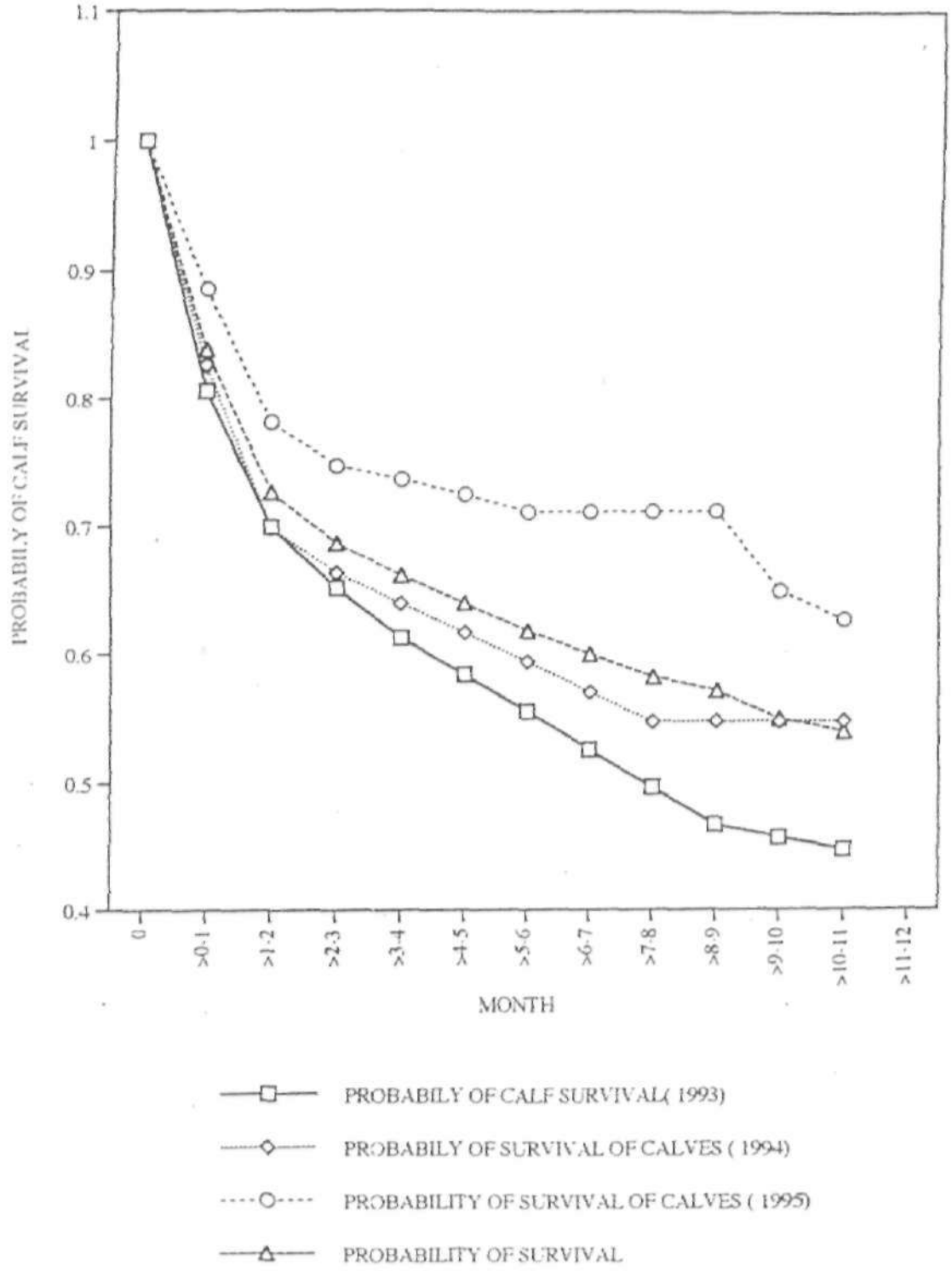


Fig 9: Life Table of Survival of Calves in Bauchi (1993–95).

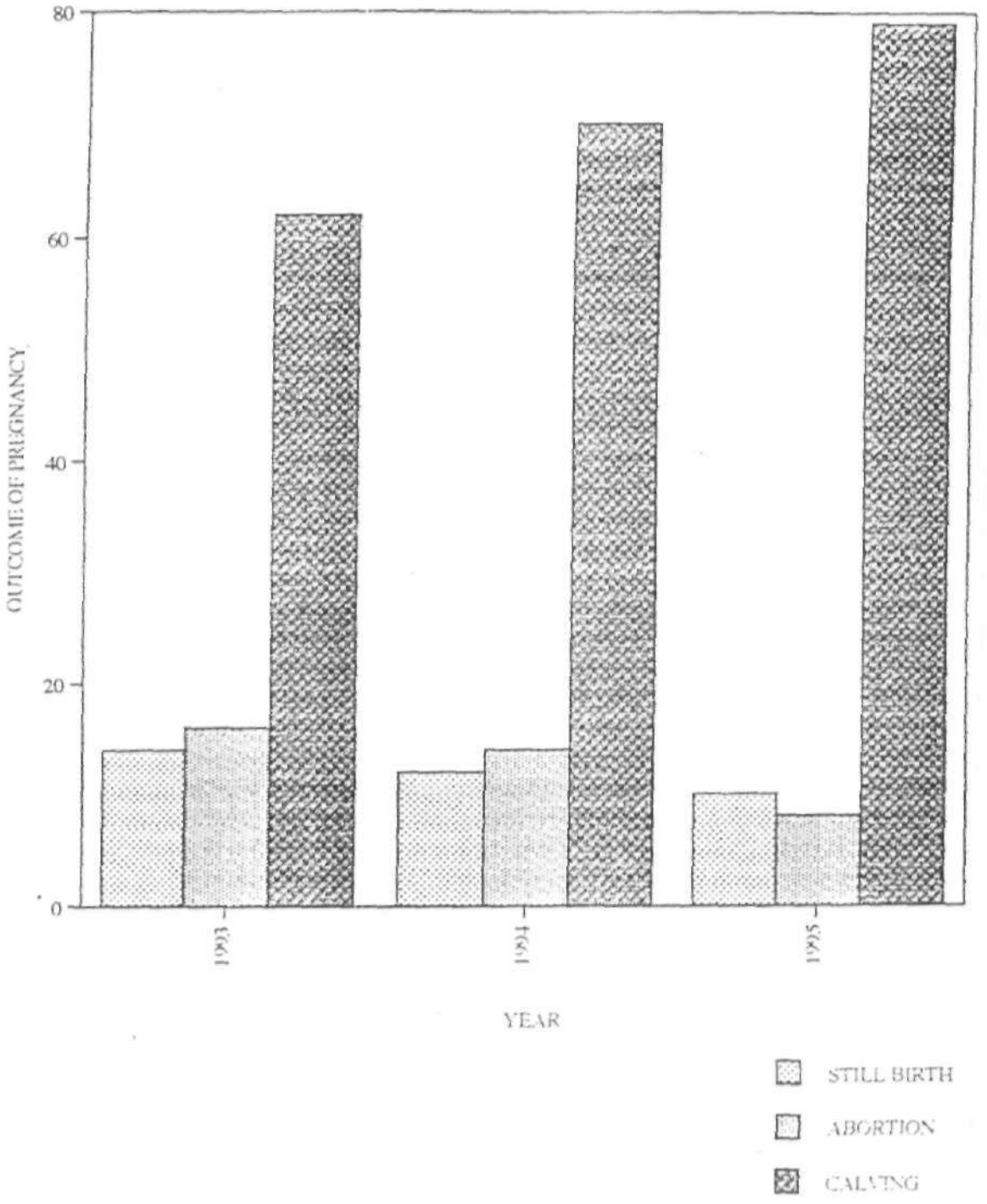


Fig 10: Outcome of Pregnancy During the Study Period (1993–95).

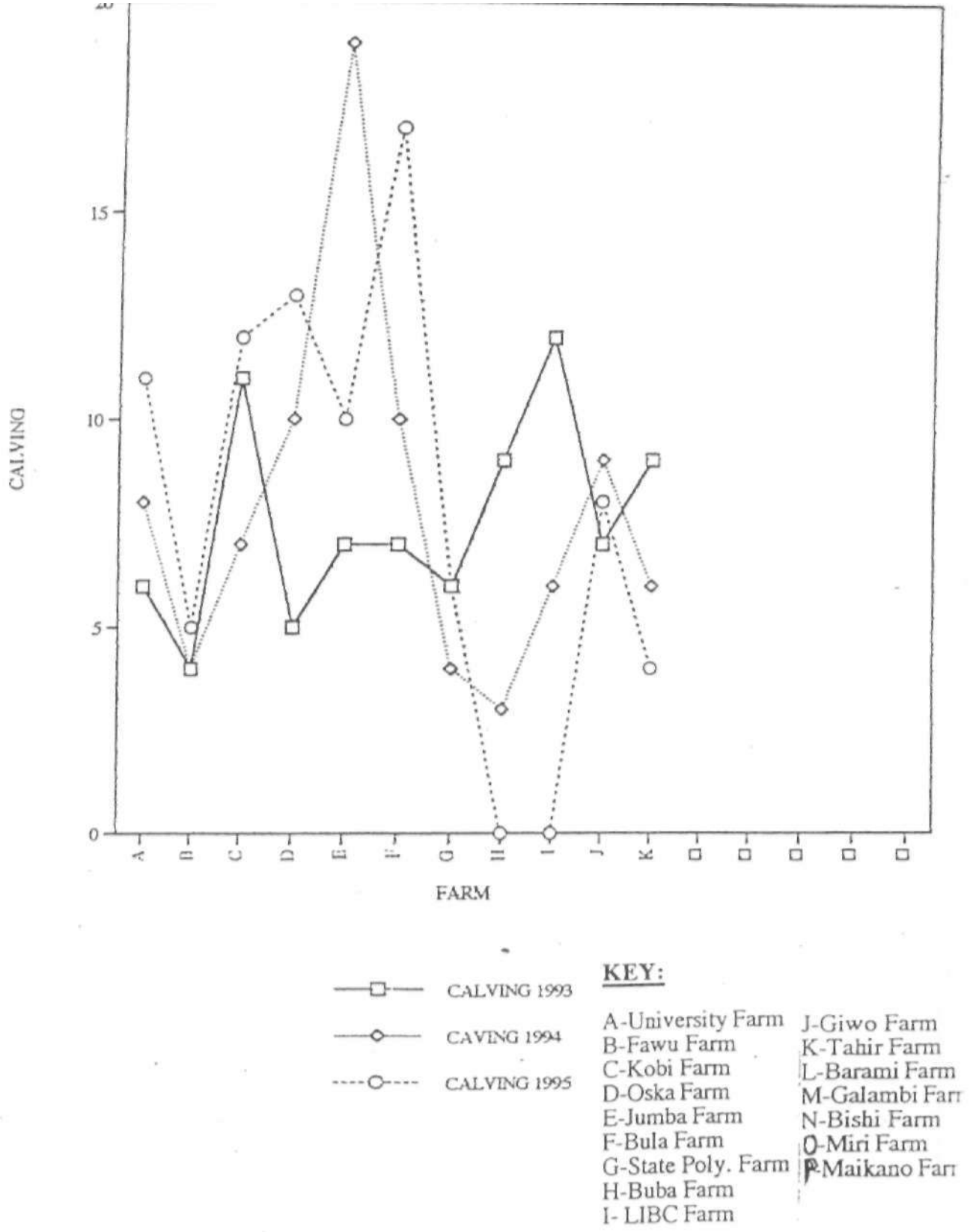


Fig 11: Yearly Distribution of Calvings in 16 Herds in Bauchi.

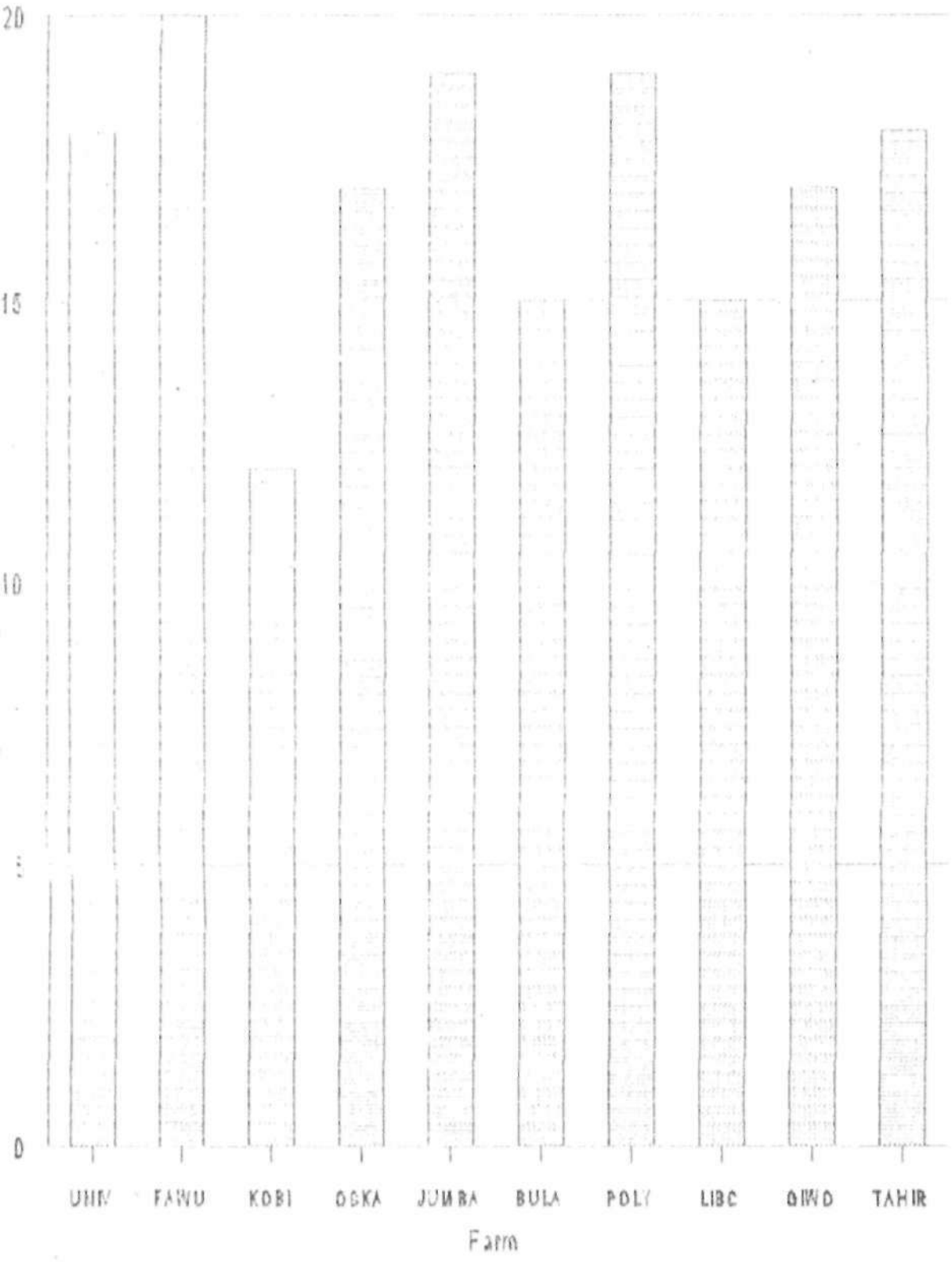


Figure 12: Average Calving Interval of 10 Farms in Bauchi.

CHAPTER 5

5.0 DISCUSSION:

5.1 LIVESTOCK MANAGEMENT SYSTEM:

The livestock management system practised in the study area was found to be the same for all the herds (Table 1). All herds were found to graze natural pasture with little or no supplementation. The farmers prefer growing food crops on their lands to providing an area specifically for the grazing of their cattle. However, in the government and institutional herds, grazing areas were provided but there were no efforts to plant grasses and legumes to improve the pasture. These common characteristics indicated that the variation in farm performance was due to differences in the quality of land, scale of operation, labour and capital inputs. Apart from the institutional and governmental herds, the other herds were managed by illiterate staff, who could neither read or write and so no records were kept in such farms. It was also discovered that the non-institutional farms (Fawu, Kobi, Oska, Jumba, Bula, Buba, Giwo, Tahir, Barami, Bishi, Miri, and Maikano farms) engaged the services of unqualified personnel as veterinarians. This compounded the problems of the herds as these quacks do not have the know-how to handle clinical diseases.

Another problem encountered at the beginning of the study was that not a single herd had records. The author established records in all the herds and these were in most cases maintained by him because most of the herd owners saw it as a waste of resources and source of farm exposure even after explaining the role of record keeping in herd improvement. Also most of the managers were found to be illiterates, hence cannot keep records. Advice was given to the herd owners to change their illiterate staff but were rejected because most of the managers were either family members or relatives. Because also the records were kept by the author, some information, especially those relating to purchases and sales were not released by the herd owners. They regarded releasing information on sales as *peering into their businesses/affairs.*

With the bad management practices encountered, regular advice given to the herd owners on system of production, breeding, feeding, housing, and health were either not fully implemented or implemented too late to have significant effect. This led to the Herds not performing as expected and confirms the fact that a successful herd health programme requires the co-operation of all involved such as the herd owner, the management, the nutritionist, the breeder and the veterinarian who is the motivator of any system of health control (Bigrass-Poulin *et al.*,1984a,b,; Blood and

Radostits, 1985). On the other hand, institutional herds, eventhough managed by literate managers, had the problem of bureaucracy which made implementation of recommendations at times come too late. It was also observed that managers in all the herds did not have specific responsibilities. Lack of defined responsibilities for managers of herds affected the herd health programme by leaving many things undone leading to poor production (Blood *et al*, 1978).

The observed problems associated with management systems in the lands are more likely to result from breakdown of traditional management practices due to human population increase and external intervention or social changes or from abiotic factors such as climatic variation than from flaws in the traditional system (Gefu, 1987). That was why the fulani herds in this study were semi-settled and had to disappear due to the fact that they were advised to cull some of their animals that had tuberculosis and brucellosis. Amongst the 16 herds, 8 practised mixed farming whereby the crop residues were used to feed the animals during the period of feed scarcity. The rest of the herds purchase such residues to feed their cattle during the same period. This gave the same feeding pattern for all the herds and that was why differences amongst the herds were not much. Cattle fed on pastures and crop residues only rarely had enough mineral

supplementation and this affected their performance in general (Oyedipe *et al.*, 1982a,b). In this study, all herds were given mineral licks to help combat the effect of lack of minerals in the diets of cattle as an incentive by the author for allowing the use of their herds for the study.

5.2 HERDS SURVEYED:

A total of 702 cattle were surveyed in the 16 herds at the start of the study. By the end of the second year only a total of 451 cattle were surveyed (Table 2, 3, and 4). This was because 6 of the fulani herds and one government herd dropped from the study (Table 4). The fulani herds were lost due to suspicion that the study was for cattle tax assessment *despite assurances that it was not and because of recommendation* regarding the culling of diseased cattle. The average herd size was 35 and most herds kept many bulls of breeding age in the herds. This agrees with other works around the same sub region (Nuru and Denis, 1976; Otchere, 1986). The herds were not properly structured and this was because of the presence of many breeding and mature bulls in most herds. This probably resulted in some management problems like cows being on heat but not served by bulls because of in fighting, hence chances of the cows being pregnant passed. Attempts to introduce controlled mating and reduce the

number of bulls to achieve the required cow:bull ratio were rejected especially by the fulani herds that had the belief that their status in the society is enhanced by the total number of cattle they own (Gefu, 1987). In the institutional herds, the problem was that of bureaucracy which when culling was to take place, many of the high ranking officers in the establishment went for all good looking cattle rather than those that were to be culled, thereby removing from the herds productive cattle. With the above problems, the productivity of the cattle was grossly compromised. Added to this is the fact that the productivity of the zebu cattle under traditional management systems is generally low (Otchere, 1986; Pullan, 1979).

5.3 DISEASES:

5.3.1 Parasite;

Babesiosis and anaplasmosis were the only haemoparasitic diseases encountered in all the herds during the course of this study. Babesiosis and Anaplasmosis, which are tick borne diseases, were found to have high incidence in most herds in the first year of study, which reduced greatly in the second and third years except in Kobi, Bula and Tahir herds (Table 5).

This was because of new additions to these herds. The improvement with year was due to prophylactic treatments instituted on herd basis during the course of the study and also effective tick control. Haemoparasites are known to limit animal production in many parts of Africa (Ajayi, 1995; Jawara, 1990). Most infections in the herds were with *Anaplasma* species, with few *Babesia* infection and were found to be distributed seasonally (Fig 1) with most infections in the rainy season. This could be because most of the ticks identified during the course of the study were *Amblyomma* and *Hyaloma* species, which are known to transmit these two haemoparasites.

The helminth infection was mainly due to strongyles. Higher prevalence in the first year reduced in the second and third years in all herds except Fawu and Kobi herds where there were increases in the third year. This was due to new additions with late institution of deworming programmes. The study also showed a seasonal trend in the distribution of the endoparasites (Fig 1), with high infestations in the rainy season. This agree with the works of Fabiyi (1984) and Istifanus et al., (1990) who reported that outbreaks of helminthiasis occurred generally during rainy season. It also demonstrated negligible peak of infective larvae or eggs during the dry season with a carry over of these infective materials in the host from one wet season to the next. The seasonal distribution was used, during the early part of the study,

to device control measures by deworming herds during the rainy season hence the improvement noticed. Because the effects of helminthiasis was very clear to the herd owners, all herds participated in the deworming programme instituted. The extensive nature of the area grazed by the herds tended to keep cattle dispersed until the second half of the dry season when the cattle congregate at boreholes, dams, or other drinking areas. One would assume that it would be in this period that there would be an increased pick-up of any infective larvae or eggs but the effect is mostly sub-clinical and sub-clinical infections are responsible for the decrease in the productivity of herds (Blood and Radostits, 1985).

At present, control of helminths in most cases is protective in orientation and is based almost entirely on the regular use of antihelmintics. While usually affording protection against serious disease and mortality, such treatments are frequently not effective in preventing the exposure of cattle to high levels of infective larvae or eggs on pasture. Consequently, production losses can still occur as a result of re-infection in the interval between treatments (Georgi and Georgi, 1990; Ogunsusi, 1979). In this study, helminthiasis was not found to directly affect cycling (Table 32). Their effect could be subclinical and may be seen over a long period.

Similar trend of distribution of ticks infestation (mainly Amblyomma and Hyaloma) was observed in this study as that of haemoparasites and helminths. All showed seasonality in distribution (Fig 1). This could be because our environment is rife with vectors and disease causing agents (like ticks and helminths) especially during the rainy season when moisture, humidity and temperatures favour their development and propagation (Jawara, 1990). In the tropics, ticks are very important because of their economic impact on livestock industries (Mohammed, 1984). They depress productivity of livestock especially in terms of decrease live weight, milk yields and long calving interval (Eduvie et al; 1993).

5.3.2 Other Diseases;

Cattle that reacted positive to tuberculosis and brucellosis were recommended for culling. Nine (9) farms implemented the recommendation and culled all reacting cattle. Culling due these two conditions were done because of fear of human infection and to improve productivity. Seven (7) of the herds, mainly owned by the fulanis refused to cull their reactors so emigrated from the area. In one of these herds, Miri farm, milk from 13 lactating cows that reacted positive for tuberculosis, was being sold to the people in Bauchi town. The attention of the Director of the State Veterinary

Services was drawn to the herd and while the Director was planning to take action, the farmer disappeared with the herd and could not be traced. The positive cases encountered during the third year of study was due to new additions. Tuberculosis is believed to be widespread in fulani herds and some institutional herds (Ladan, 1988). Economic loss to the cattle industry are so great that it is difficult to quantify. They result from milk and meat condemnations, decrease in life span of breeding cows, insufficient feed utilisation, decrease milk production, infertility, poor condition and low market value (Alhaji, 1976; Eid, 1976). The result from existing records indicates that brucellosis in Nigerian livestock has existed for a long time and showed from this study that it is still a major problem (Bale and Kumi Diaka, 1981; Esuruoso, 1979). One of the major factors contributing to the spread of the disease is the free movement of the nomadic fulani herds and the indiscriminate buying of cattle without screening for the disease (Ajayi, 1995). The culling of reactors was the most effective way to control these two diseases.

Culling cattle due to other conditions like dermatophilosis, old age, malnutrition and reproductive failures were done to improve productivity. More cattle were culled in Kobi, Oska, Jumba, Bula and Tahir herds and most of the culling was due to dermatophilosis (64.9%) and old age (16.2%).

Also more culling was done during the rainy season (Fig 2 and 3), because the conditions, mainly moisture, high humidity and high vector population are conducive to and hence enhanced the propagation of these conditions (Bida, 1975; Kelly and Bida, 1970; Oduye, 1976; Oppong, 1973). In Nigeria, studies have shown that the Bunaji cattle are very susceptible to dermatophilosis (Coleman, 1967) and this was the case in this study.

5.3.3 Mortality Pattern;

Mortality pattern during the study period showed that most herds had high mortality rates (Table 15). Higher incidence of mortality seen in non institutional herds may be due to poor management since most of the managers in such herds were illiterate and did not respond properly to health needs of the herds because they use the services of quacks. High incidence of mortality in Kobi, Oska, University, Bula and LIBC herds were found to be due to management changes after the death of some of the herd owners and due to bureaucracy in the institutional herds. A similar pattern, as in adult, was observed for calves.

Calf mortality rates were higher in Kobi, Oska and Barami herds than in the rest of the farm. The reason for the high calf mortality in these herds

include poor management of calves, diseases and adverse weather conditions like heavy rain, severe malnutrition and harmattan. Proper calf management, which involved ensuring that calves took colostrum immediately after birth, good hygienic practices and sheltering from adverse weather conditions were introduced to the herds and eventhough not properly implemented, led to some reduction in the calf mortality rates (Table 18, Fig 6). The State Polytechnic and Tahir herds, however, showed increased mortality rate in the third year. This was found to be due to changes made in the management staff from the ones that started the study. In those herds studied for 3 years, the overall calf mortality rate (Table 18) showed that Kobi, Oska and Giwo herds had more than 50% mortality rates. The reason was that for, Kobi herd, the herd owner was diagnosed with lung cancer and hence all attention was diverted to him and the herd was neglected, while that of Oska herd died. In all the three herds, management was affected and hence the result obtained. In all, more calves died than adults and this is because of the vulnerability of the calves and the difficulty in managing them.

Calf mortality rate by ages of calves showed that most of the calves died between the ages of 1 and 3 months. This was because in that age range, management is very delicate since they are more susceptible to diseases

and other harsh conditions. When they reach the age of 4 months, their immune system is well developed and hence their rate of survival increases (Fig 8). The probability of survival of calves showed that more calves survived with increase in age. It also showed by observation that as the study progressed and as herd managers implement some suggestions given to improve productivity, the probability of survival after 11 months increased from 44% in the first year to 54% in the second and subsequently 62% in the third year (Fig 9).

The cause associated case-fatality rate for adults showed that most *adults died from poisoning (mainly plant poisoning), foot and mouth disease*, coccidiosis, septicaemia and CBPP. They were mostly management diseases and their propagation in the herds was due to poor management in relation to prompt and adequate vaccinations, maintenance of good hygiene, seeking proper veterinary medical attention on time and isolation and treatment or culling of very sick animals. Septicaemia, malnutrition, calf scour, gastro-enteritis, coccidiosis and pneumonia were the major causes of death in calves. The commonest diseases encountered in calves were calf scour and pneumonia and were responsible for high number of deaths as compared to the other conditions (Table 25). This may be due to poor calf management noticed in the herds and poor hygienic practices. In a

similar study around the same sub region, Voh Jr. *et al.*, (1993) found that helminthiasis and pneumonia were the major causes of deaths in both adults and calves. The difference with this study may be that the good control measures introduced for helminthiasis, through strategic deworming, helped in removing helminthiasis as one of the main killers of calves. Also the present study considered both sub-clinical and clinical diseases while the earlier study by Voh jr *et al.*, (1993) was diagnostic.

The distribution of diseases during the study period showed that for both adults and calves, pneumonia, gastro-enteritis and diarrhoea ranked highest and were mostly seen during the rainy season because the conditions for the propagation of the aetiologic agents of these conditions were suitable during the rainy season and poor management enhanced their infectivity and spread within and among herds. In the dry season, inadequate feed (malnutrition) was found to be the major problem and it often aggravates slight infections leading to wasting and even death in some cases.

5.4 REPRODUCTION;

In this study, the age at first calving for cows was found to be between 4 and 5 years. Pullan (1979) and Otchere (1986) had reported a similar age at first calving for the same breed (Zebu) of cattle as those monitored in this study, hence confirming the fact that Zebu breed of cattle have an average age at first calving of 5 years. Higher age at first calving could be due to nutritional stress experienced in the savannah region of the country (Pullan, 1979) and may be responsible for this and earlier findings. This is so because there are reports that have shown that under improved management, where seasonal nutritional stress can be reduced, it is possible to achieve first calving at about the age of $3^1/_2$ years (Oyedipe *et al.*, 1982b). The nutritional factor and other management factors in this study have also contributed to the less number of calvings by aged cows since most cows may have missed out on cycling and mating. This led to only 7.6% of some of the breeding cows observed having more than 2 calvings and 0.5% 3 calvings prior to being culled or lost through death.

The total number of animals pregnant and the outcome of pregnancy showed that more cows calved and the frequencies of abortions and stillbirths decreased as the study progressed up till the third year (Fig 10).

This was associated with the improvement in disease control and general management introduced in the herds. Eventhough the aetiologic agents of the abortions and still births were not determined, the 2 cases, from Jumba farm were probably due to brucellosis because their dams tested positive for brucellosis. Yearly calving by herds improved from the first year to the second and third years (Table 27) and calving rate (Table 28) also improved in a similar manner except in Jumba, Giwo and Tahir herds (Fig 11). This was found to be due to culling of old and diseased cows after the herd owners have seen the effect of bad management when the first year result was compared to the second year and they saw some improvements.

The reproductive status of postpartum cows in relation to the age of postpartum period (Table 29) showed that many cows return to cycling again after a period of 6 to 12 months. The reason may be, as stated by Wenkoff and Crowe-Swords (1983), that if cows are fed inadequately both before and after calving, the onset of oestrus will be delayed, conception rate in the cows that are cycling will be depressed and some cows will fail to cycle or become pregnant throughout the breeding season. It would then seem that where there are marked seasonal fluctuations in availability of forage, conception will coincide with high nutritional plane (Butterworth, 1983, Wilson, 1985).

The calving interval in all the herds showed intervals of more than a year (ranging from 15 months to 19 months), which in any cattle production, are very long. This finding agrees with many works on calving intervals of cattle *indigenous to Nigeria because of the traditional method of management* practised generally (Akpokodje and Bolarinwa, 1974; Lamorde and Franti, 1973; Oyedipe *et al.*, 1982a). Reasons for these long intervals have been attributed to long suckling of the dam by calves which affects ovarian activity and subsequently calving interval (Eduvie, 1985; Eduvie and Dawuda, 1986) and poor management with high disease incidence(Table 33) (Blood, 1989).

The relationships between parasitic infections/infestations were found not to directly affect cycling in this study. This is not suprising as most of their effect is subclinical. The significant relationship between nutrition and cycling and cycling and pregnancy in all the herds. showed that with poor nutrition the cows will not cycle and conception will eventually be affected. Thus, it is difficult to improve reproductive efficiency without proper and adequate nutrition.

5.5 ETHNOVETERINARY STUDY:

Traditional medicinal plants, used by the pastoral Fulbe for the treatment of various conditions, analysed for antiviral activity yielded encouraging results. Six out of the 13 plants tired on *Poliovirus* and *Astrovirus* in vitro have some anti viral activity and were not cytotoxic. Two of the plants were also found to have broad spectrum antibacterial activity (Table 37). The active ingredients of these plants were not determined. African livestock producers especially the pastoral group have, before the advent of modern (western) veterinary intervention relied exclusively on the use of locally available plants and herbal forage in coping with various animal health problems. Many of such medicinal forage plants have , however, received little research and development attention (Gefu and Otchere, 1994). The result of this trial will help to stimulate vigorous research in the animal health delivery system using medicinal plants. There is, therefore, an urgent need to understand and try the valued medicinal forage available in the country and ensure continuity of knowledge and technology transfer of the preparation of important locally-sourced therapeutic agents for the control of some or lots of animal diseases.

5.6 INTERVENTIONS:

During the course of the study, recommendations on vaccinations, feeding, prophylactic treatments, culling of unproductive cattle, record keeping and other general management were given to all participating herds. All herd owners responded to vaccinations because they were given free by the author. Herds were vaccinated against rinderpest and CBPP and in few cases against anthrax and black quarter. Deworming and spraying against ticks were done in most of the herd except in cases of some fulani herds (Maikano, Miri, Barami and Bishi) where hand picking was used for tick control and plant extracts used for deworming. Feed supplementation using crop residues was given when available. The farmers were advised to buy and store alot of crop residues during harvest period for use during the period of scarcity. This they did and that was why some improvement was seen especially during the third year for animal health and production indices.

Most diseased and unproductive cattle were culled in most herds except some fulani herds where it resulted in their dropping from the study and leaving the area all together. Employing qualified managers was one point rejected by all herds except the institutionalised herds. This was because

most of the herds have family members managing them even though illiterate. Because of this, proper and good management was lacking leading to lack of clear quantifiable benefit of the herd health programme. Problems of keeping records of purchases and sales worsened the situation as cost-benefit analysis could not be done. The reason for all the suspicion was found to be due to the fact that they suspected the study was commissioned for cattle tax. Even the institutionalised herds, bureaucracy kept such records away. The entire project is considered successful, as it has clearly identified some of the constraints to herd health and showed the increases in production noticed for the herds studied for 3 years.

5.7 CONCLUSION:

In conclusion, this study was able to show that a herd health and production programme was practicable in this country and could be undertaken to improve productivity of our indigenous breed of cattle. It was able to show improvement in management, decrease morbidity and mortality, improved reproductive status of the herds and also identified constraints to herd health and

production programmes.

This type of programme requires the veterinarian to be very competent, the herd owners to be very cooperative and the goal of the farmer clearly defined in order to obtain maximum result. The programme involved a simple system, in which the veterinarian visits the herds on a regular basis to examine animals and their performance and to make recommendations for the control of diseases and improve production. The performance of these herds improved with regards to increased calving rate, decrease morbidity and mortality, increase survival of both adult cattle and calves, improvement in the area of preventive medicine such as annual vaccinations, prophylactic treatments, good hygienic practices and understanding the epidemiology of the various diseases. One of the most significant findings of this study was the vital role the veterinary component played in the promotion of herd health programme to farmers evident by the improvement noticed on herd basis, herd approach to disease management and situations and improvement in management skills.

The constraints to herd health and production programme

encountered included, unco-operative attitude of the herd owners, poor management practices, inadequate feeding, diseases, lack of records and Input factors. These constraints could be overcome if the farmers are educated on the effect of subclinical diseases on production and the role of herd health programme in improving productivity as demonstrated in this study. There is a need therefore for an intensive programme, in which the veterinarian, with the assistance of other animal specialists, like animal nutritionist, geneticist, breeders, sociologist, economist and extension workers to make detailed recommendations about the daily management of the animal health and production programme. These may include recommendation on nutrition, control of diseases, genetic improvement, purchase of breeding stock, housing and culling of unproductive animals and other production indices. Another area of urgent research is in the area of ethnoveterinary medicine where extensive study is required to ascertain the uses, active ingredients, doses, toxicity and mechanism of action of our traditional medicinal plants use in traditional veterinary practice in Nigeria.

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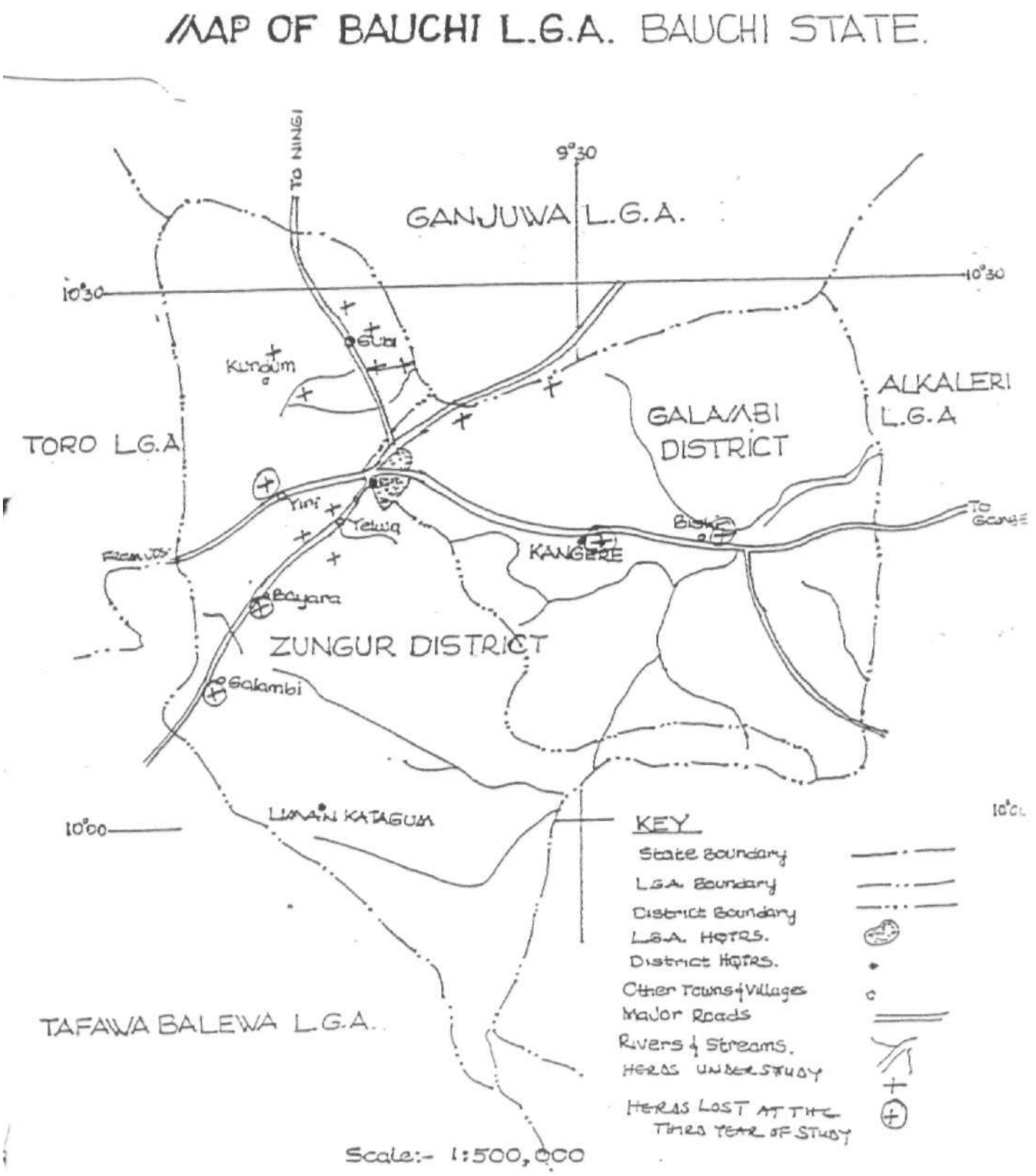
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APPENDIX 1


MAP OF BAUCHI L.G.A. BAUCHI STATE.
TO NINGI
9°30
GANJUWA L.G.A.
10°30
10°30
Kirfaum
Gubi
TORO L.G.A
GALAMBI DISTRICT
ALKALERI L.G.A
Yiri
Yelwa
KANGERE
TO GOMBE
Bayara
ZUNGUR DISTRICT
Galambi
LIMAN KATAGUM
10°00
TAFAWA BALEWA L.G.A.
KEY
State Boundary
L.G.A. Boundary
District Boundary
L.G.A. HQTRS.
District HQTRS.
Other Towns & Villages
Major Roads
Rivers & Streams.
HERAS UNDER STUDY
HERAS LOST AT THE THIRD YEAR OF STUDY
Scale:- 1:500,000

APPENDIX 2

ANALYSIS OF ANIMAL PRODUCTION IN BAUCHI DISTRICT

GENERAL QUESTINNAIRE

Serial no.: ----------

Name of owner/farm: ----------

Location:----------

Management: ----------

Intensive:

Extensive:

Nomadic:

Semi Normadic:

Semi-Settled:

Settled:

Cattle:

Total No. of cattle:

Bulls:

Cows:

Heifers:

Calves:

Classification of Age groups:

1 year	1-2 years	2-3 Years	3 Years

Goats:

Total No. Of Goats:

Bucks:

Doe:

Kids:

Sheep :

Total No. of Sheep:

Ram:

Ewe:

Lamb:

Other type of animal on the Farm ----------

Purpose of the Farm ----------

Breeding Method:

Natural Mating: ----------

Artificial Insemination:----------

Others :----------

Pregnancy (last one Year):

No. Pregnant:----------

No. that aborted----------

Any disease outbreak: Yes ( ) No ( )

If yes, type of disease:

Morbidity:

Mortality:

Treatment given:

Vaccination record:

Rinderpest ( )	*Date*:----------
CBPP/CCPP ( )	Date:----------
Black quarter ( )	Date: ----------
Anthrax ( )	Date: ----------
Others (specify)	Date:----------

Ratio of females to Males:

Cattle:		Adult	Calves
	Females:		
	Males:		
Goat:	Females:		
	Males:		
Sheep:	Females:		
	Males:		

Treatment Record:

Disease	Treatment	Response
----------	----------	----------
----------	----------	----------
----------	----------	----------

Feeds/Feeding:

Type of feeds available:

Frequency of Feeding: ----------

Supplementation (if available):

Housing:

Cattle:

Type:

Floor: Concrete:---------- Sand: ----------

Facilities in the Housing:

Prevalent Diseases: (last 1 Year):

7th July, 1994.

The Area Veterinary Officer
Area Veterinary Office
Ran-Road
Bauchi.

Dear Sir,

REPORT OF EPIDEMIC OF BOVINE TUBERCULOSIS.

I am writing to notify you that after testing the Cattle, at Zamfara Village on Jos Road, for tuberculosis using the Bovine PPD at the Caudal Fold, Thirteen(13) were found to be positive for the disease.

Also, there were 2 accompanying herd that refused to allow their herds to be tested.

In view of the public significance of this disease, I am calling on you to notify the Director Vet. Services to take the appropriate action.

Find attached the result.

Dr. A. C. Kudi.