Chapter 2: Guide II

2.1 Introduction of a Final Year Student Project

The introduction of any project work should answer the questions: Why did the researcher do the work and what did he/she want to find out? The introduction should be short, explicit, preferably not more than two pages for undergraduate and two or more pages for postgraduate programmes. All information put in an introduction must be essential for the understanding of the issue on ground. This part of the work forms chapter one of a project work. Therefore, this should contain four parts:

2.1.1 Background of the Study

This is a brief review of relevant literature and the logical development that led the researcher to do the work. This is to briefly preview any relevant information or facts about the study title prior to this research in order to allow the reader evaluate the present work.

Example of background information of research work titled: *Seasonal Feed Resources Characteristics and Morpho-Physiological Conditions of Cattle Grazing the Guinea Savannah Zone of Nigeria* is given as follows:

Cattle production and breeding in Nigeria is predominantly controlled by pastoralists who constitute a major socio-economic group in the country (Nweze *et al*., 2003; Nori and Davies, 2007; Moutari, 2008). These nomads own more than 93% of the country's estimated 15.3 million cattle population (Umar, 2007; Umar *et al*., 2008; Tibi, and Aphunu, 2010). Pastoralist livestock industry is the country's reservoir of animals for slaughter, milk, animal manure production as well as draft power (RIM, 1992; Parton *et al*., 2007 and Kubkomawa *et al*., 2011). The industry also contributed 19% in 1983 and 1984, 10% in 1998 and 6 % in 2004 and 2005 to agricultural production and 3.2% - 4% to overall GDP of the country (FAO, 1999; CBN, 1999; Mbanasor, 2000; Ifeanyi and Olayode, 2008).

Cattle are produced predominantly in the northern Nigeria where savannah grass pastures are found in abundance. The area, especially the semi-arid zone, is characterized by low rain fall regimes and humidity (Fricke, 1993 and RIM, 1992). The region also has abundance of crop residues and fodder to supplement for the dry season feeding of cattle. There is also prescribed bush burning at certain periods of the year to control parasites and allow for the re-generation of fresh forage for livestock (Fricke, 1993). The pastoralist cattle production system that evolved over the centuries in the zone is based on

grazing animals on natural communal pastures and complementary use of fodder and crop residues (Muhammad and Ardo, 2010; Nweze *et al*., 2012). The system has been defined as an adaptation to the hash and variable physical and environmental conditions of marginal rangelands with a view to harnessing the otherwise un-utilizable biomass for production of livestock (Niamir, 1991). There is, therefore, a transhumance or seasonal cyclic movement of animals and farming families in synchrony to the rain fall regimes that drives biomass availability (Moran, 2006; Okoli and Kalla, 2008). This transhumance is, however, constrained by threats of animal diseases; insecurity, conflict and shortage of forage and water resources for livestock (Muhammad and Ardo, 2010). Transhumance livestock management specifically is becoming increasingly difficult in northern Nigeria due to lack of access to enough land in the wake of rapid population growth and agricultural expansion which result in competitive demand for land resources. The current land use pattern and natural resource development and conservation in Nigeria show that pastoralism is at cross-roads with uncertain future. Livestock development and empowerment of pastoralists is plagued by a number of problems which may include, among many others, diminishing land space for grazing and stock movement; deterioration of existing rangelands with low biomass yields; scarcities of water; poor carrying capacities of available land; concentration of endemic diseases and parasites; low literacy rates and physical isolation of pastoralists; environmental constraints; absence of functional extension services; skewed agricultural development policies as well as an enduring disconnect between government and aspirations of the pastoralists (Okoli and Kalla, 2008; Muhammad and Ardo, 2010).

To the south of this pastoralist zone is the guinea savannah zone that has more abundant rain fall, biomass resources and permanent water sources. However, this and the rest of the rain forest zones further south are notoriously infested with tsetse fly, the vector of trypanosomiasis, and other humidity related diseases and have therefore prevented the sustenance of pastoralist cattle production for ages (Ikede and Taiwo, 1985; Anosike *et al*., 2003). These southern zones are home to major crop production activities in the country. Recent prolonged droughts, resulting in shortage of forage and water resources, more efficient control of tsetse fly down south, the widespread availability of veterinary medicines and the increasing use of cross-bred cattle have led to increased migration of the pastoralists and their animals into the guinea savannah and forest zones of Nigeria. In addition, changes in the political economy of regional livestock markets and ownership have contributed to movements of pastoralists to the south even though they are faced with conflicts of various degrees with indigenous crop producers (Blench, 2010; Nyong,

2010). Thus, the humid tropical rain forest zone of southern Nigeria has become a haven for some pastoralists and their livestock (Okoli *et al*., 2012). However, such conflicts with crop farmers threatens pastoral access to shared material resources, thus, impacting negatively on the sustainability of pastoralism in the forest zones (Tonah, 2006; Ofuoku and Isife, 2009; Okoli *et al*., 2012). Current approaches of preventing these conflicts show that controlling reproduction of animals within the carrying capacity of available land is critical (Okoli *et al*., 2012).

The northern zones, therefore, remain the major environment for cattle production in Nigeria. The breeds of cattle produced in the region are the indigenous Zebu cattle such as white Fulani (Bunaji), Red Bororo (Rahaji), Sokoto gudali (Bokoloji) and Adamawa gudali (RIM, 1992; Umar, 2007; Addass, 2011; Kubkomawa *et al*., 2011). Cattle are highly valued livestock in these northern zones, where it contributes to the local economy and food security. Pastoral production systems play a central role in providing livelihood for rural people, ensuring productive use of marginal lands and contributing to internal trade and earnings (Moutari, 2008). A cattle farming is also a source of employment in the zone (RIM, 1992; Tewe, 1997). Cattle are kept mostly for beef, milk, manure, hide and skins as well as for draught power to plough lands (Tukur and Maigandi, 1999; Kubkomawa *et al*., 2011). They also serve other socio-cultural functions such as payment of bride price, transportation of goods and people, prestige and symbol of economic status (Walker and Salt, 2006; Klein *et al*., 2007).

The feed resources of pastoralist cattle consists mainly of grasses, legumes, browses, and cereal crop residues indigenous to the production zones and have been reported to be of low yield and quality (Shiawoya and Tsado, 2011; Nweze *et al*., 2012). Good quality forage is available in adequate amounts to support reasonable level of cattle production from early to late rainy season (Moutari, 2008). During this period, abundant cattle populations are found in the north (RIM, 1992; Roger, 1999), while at other times, pasture and range plants decline in quantity and quality (Moutari, 2008). During the dry season period, available natural pastures are low in protein, nitrogen, sulphur, vitamins and other nutrients, while fibre is high with dry matter content of more than 30% (Hughes *et al*., 2011). Considerable quantities of crop residues and agro-industrial by-products are also generated every year. However, because of improper management, they are usually lost, wasted or underutilized.

There is a relationship between body condition scores (BCS) of grazing animals and feed availability (Waltner *et al*., 1993). Malnutrition, old age and sickness are major causes of low body condition scores in cattle which affect

every area of production (Drennan and Berry, 2006). Older cattle have less fat over their backs and *Bos indicus* cattle carry more external and internal fat than *Bos taurus*, so also bulls have higher BCS compared to cows (Joe, 2010). A cow's reproductive performance is closely associated with her body energy reserves (Clay *et al*., 2002). For example, a low feeding level at service can reduce reproductive efficiency. Similarly, cows with low body condition scores have reduced fertility rates, milk yield, late postpartum oestrus and low weaning weights (Clay *et al*., 2002).

Body condition scores improve with nutrient availability (DEFRA, 2001) and because of this, it usually serves as a more reliable indicator of nutritional status of animals than body weights (Waltner *et al*., 1993). The general purpose of condition scoring is to achieve a balance between economic and efficient feeding, good management, market weights and welfare (Waltner *et al*., 1993). Addass *et al*. (2010) investigated physiological consequences of season, breed, body condition score and age on epididymal sperm reserve of bulls and showed that reserves were highest during late rainy season in Red Bororo bulls, four years old at BCS 5, which corresponded with the period of feed availability in Mubi, north-eastern guinea savannah zone of Nigeria.

According to Assan (2012), genetic make-up play vital role in reproduction efficiencies, weaning weights and body condition scores in cattle. Higher body condition scores precede higher dressing out percentage with good quality meat which also attracts greater market values. However, production without access to market is a problem for many livestock producers in Nigeria (Usman and Nasil, 2005). Pastoral populations in Northern Nigeria lack reliable marketing outlets that could provide the full benefits of indigenous cattle resources, to be captured by both pastoralists and consumers in the region and beyond. Market prices of cattle in Nigeria are determined by visual evaluation which incorporates elements of BCS, ages, sexes, breeds, live weights and grade (Okoli *et al*., 2005; Adugna, 2006; Tibi and Aphunu, 2010; Mukasa *et al*., 2012).

According to Hughes *et al*. (2011) traditional methods of reducing morphometric effects of lean feed resources period remain forage conservation either as hay or silage during times of abundance to off-set pasture deficit during the dry season. This may serve as a suitable strategy to mitigate the effects of inadequate pasture during the dry season, while supplementing inadequate pasture with tree fodder provides another cost-effective alternative (Adegbola, 1998). However, there is a significant shortfall in supply of the forage, particularly, when required for longer periods. Concentrate supplementation has also been traditionally seen as a reliable strategy; however, cost and availability of local concentrate sources is a major deterrent (Hughes *et*

al., 2011). Use of crop residues and agricultural by-products as intervention nutrients is also commonly practiced (Ibrahim *et al.*, 1983). Movement of animals and splitting of herds have been used by Pastoralists to reduce morphometric effects of lean feed resources period (Ezeomah, 1987; Mathias-Mundy and McCorkle, 1989).

The continual increase in the price of veterinary drugs coupled with their prolonged absences from the state-owned veterinary drug store has continued to sustain the use of ethno- veterinary practices for handling different livestock diseases and parasites (Moreki *et al*., 2012). Such ethno-veterinary practices incorporate medicinal plants, which have been widely used for centuries as a primary source of prevention and control to livestock diseases (Hoareau and DaSilva, 1999). In West Africa, including Nigeria, farmers use traditional methods of curing livestock diseases because they are readily available and at low or no cost at all (McGraw and Eloff, 2008; Chah *et al*., 2009; Okoli *et al*., 2010).

2.1.2 Statement of the Problem

This is the priority problem a researcher has seen facing the society that needs urgent solution. This could be agricultural, humanitarian, managerial or administrative that may need adjustment. This problem must be explicitly and clearly stated as it gives the reader the direction of your research or study. For example, a title of research project like, *Seasonal Feed Resources Characteristics and Morpho-Physiological Conditions of Cattle Grazing the Guinea Savannah Zone of Nigeria*, should have problem statement as: The major challenge to pastoralist's cattle producers in the dry areas of Northern Nigeria is the changing environment, characterized by shrinking land due to expansion in arable farming; land excavations for construction, industrialization and mining activities, which have resulted in shortage of natural forage lands for livestock grazing. The shrinking pastoral land with the opportunities for pastoral people to make a viable living has put the industry in a serious crisis. Political and economic factors are combining to replace pastoral grazing land with other allegedly more beneficial land uses. The eroding feeding resource is also linked to changes in the economy, inappropriate aid, conversion of range lands and mixed farming systems for agriculture and game parks. Diminishing genetic resources is also evident because of product focused selection, changes in knowledge, changes in technology, intensification, lack of storage facilities and conservation and indiscriminate crossbreeding of animals and plants in many tropical environments. The idea that modern or imported breeds are better has led to a loss of knowledge about traditional livestock husbandry and to the erosion of domestic animal diversity. Wars and other forms of socio-political

problems have also led to livestock owners moving their stock out of their usual area, thus, increasing the possibility of mixing with other breeds thereby potentially losing a location-specific breed. In addition, natural disasters such as flood, drought, famine, desertification, global warming, and livestock diseases have in numerous cases resulted to breeds of cattle dying out.

The traditional Pastoralist systems in Nigeria are highly vulnerable because of heightened insecurity situations, while resilience and adaptation options are almost exhausted without any new place to go to because of conflicts with crop producers in the northern guinea savannah and southern rain forest havens. Pastoralism's decline in Nigeria is, thus, a vicious circle: pastoral land use is undervalued, and either ignored or appropriated for alternative uses, thus, making pastoralism less viable and ripe for persistent neglect or appropriation for alternative uses. Decline in the economic viability of pastoral production system has also paved way for the adoption of modern production systems coupled with the intensification of livestock production that rely on veterinary services and improved feeding conditions. Some levels of sedentary system may be the only solution to the current situation. However, the essential components of the traditional system needed to drive this, for instance, the best breeds and feed resources as measured by morpho-physiological scores of the animals across seasons need to be researched. In designing such critical studies, the questions that may need to be asked include:

1. What are the current breeds of cattle in the Pastoralist zones of northern Nigeria?
2. What are the current feed resources available to animals grazing the zones?
3. What are the seasonal effects on cattle in the zone?
4. Which cattle breeds are the most productive in the zone?
5. What are the likely improvement and intensification strategies to be employed?

2.1.3 Statement of Hypothesis

A hypothesis is a prediction or a conjecture about what can be expected to occur under given conditions stated well in advance of observation or collection of actual data. For example, if X1 takes place in a given situation, then Y will be observed. However, if X2 takes place instead, Y will not be observed. To test this prediction, the researcher provides for X1 and X2 to take place or he/she looks for a natural situation where they occur and he/she observes what happens to Y in each case.

There are two hypotheses, which include: Null (H_0) and Alternative (H_1) hypotheses. The Null hypothesis is central in research and is the hypothesis that is tested. It is stated in a negative assertion using words like No or Not. The statistical tests of the Null hypothesis may suggest the rejection of Null hypothesis at a particular level of significance and degree of freedom, as the case may be. The rejection of Null hypothesis (H_0) signals an automatic acceptance of the Alternative hypothesis (H_1). This is because both hypotheses are complementary. Therefore, every Null hypothesis must have an Alternative hypothesis to guide the researcher to look for another way of presenting the relationship between the relevant variables, in case the null hypothesis is not accepted. Example of how to state hypothesis are: H_0: There is no correlation between the productivity of intensively and extensively managed white Fulani breed of cattle in Adamawa State. H_1: There is a correlation between the productivity of intensively and extensively managed white Fulani breed of cattle in Adamawa State.

The two variables in this hypothesis are the management systems and productivity which are given as X and Y respectively. Thus, X variable (the cause), triggers Y variable (the effect) to happen. A hypothesis has several functions in research. These include the fact that:

1. It is a link between the world of reality and that of theory and explanations or abstractions.
2. It transforms the researcher's ideas into testable forms.
3. It helps to specify what variables are to be measured or collected by the researcher in order that he/she may have the expected results or discoveries.
4. It guides the researcher in his research design which helps in the generation of required data.
5. It shows the direction of data analysis.
6. It helps the researcher to organize his research reports.
7. And it helps the researcher to focus his attention and effort in the right direction.

2.1.4 Objectives of the Study

Objective of a project summarizes what is to be achieved by the study. Objectives should be closely related to the statement of the problem. For example, if the research problem is poor utilization of cassava peel diets by broilers, the objective of the study will be to identify reasons for this low

utilization, in order to improve it. If an objective states what is to be accomplished by the study in such general terms, it is called a General Objective. It is possible and advisable to break down general objectives into smaller, logically connected parts. These are normally referred to as Specific Objectives. The general objective to determine factors which influence poor utilization of diets based on cassava peels by broilers could, for example, be broken down into the following specific objectives:

a. Determine the feed intake, feed conversion ratio and weight gain of broilers fed - cassava peel diets in mash form as compared to those given in pelleted form.
b. Determine the feed intake, feed conversion ratio and weight gain of broilers fed low cyanide cassava peel diets as compared to those given high cyanide cassava peel diets.
c. Determine the feed intake, feed conversion ratio and weight gain of broilers fed methionine supplemented cassava peel diets as compared to those fed un -supplemented cassava peel diets.
d. Compare carcass composition of broilers fed the different treatments itemized in a- c above.
e. Make recommendations on how to improve the utilization of diets based on cassava peels by broilers.

The formulation of specific objectives allows a researcher to:

Focus on the study, narrow it down to essentials, prevent a researcher from collecting data which are not strictly necessary to better understand and solve the problem he/she has, organize what he/she hopes to accomplish in the study in clearly defined parts or phases. Also be guided in the development of his/her research methodology and to orient the collection, analysis, interpretation and utilization of data. Cover the different parts of the problem as defined understatement of the problem. To define the problem with precision and make for a better and commendable research report. State his/her objectives using action verbs that are specific enough to be measured. Example of action verbs include: to determine, to compare, to verify, to calculate, to describe, to establish. Avoid the use of vague non-action verbs such as: to appreciate, to understand, to study etc. Define the scope of the study: Under this sub-heading, the researcher explains his/her area of coverage trying to create another vacuum for other researchers to venture into it in later times. It gives the extent to which his/her study objective covers during the research work.

2.1.5 Justification of the Study

Here, the researcher tries to answer questions like: Is the problem at hand really worth researching? What is the severity of the problem? Is the problem noticed somewhere else? How is its effect elsewhere? See example of justification below: a title of research project like *Seasonal Feed Resources Characteristics and Morpho-Physiological Conditions of Cattle Grazing the Guinea Savannah Zone of Nigeria* should have justification as: There is limited literature on the current cattle production characteristics in a changing environment like the guinea savannah zones of Northern Nigeria. The results of the study will add knowledge to science and especially in the area of animal agriculture. Farmers and other beneficiaries such as government, researchers, national, international agencies and non-governmental organizations will find the results useful in planning and decision making on the production purposes, the periods to intensify production and when to market the products for greater profits. The results will help the Federal Government of Nigeria to develop a cattle breeding scheme to provide breeding stock to Nigerian cattle farmers. Policy makers and all stake holders will also use the data to make policies that would provide intervention strategies to lean feed resources such as fodder banking, genetic modification of the cattle, parasitic control which will help to boost and sustain animal agriculture. The results will also aid government in the settlement of Pastoralists in Nigeria through societal awareness of the detrimental effects of this extensive livestock system. Therefore, the improvement of this pastoral system without the loss of their traditional values (re-evaluation of little-productive land, environmental conservation) requires a good knowledge of their production characteristics, their strengths, weaknesses at the herd level and within the frame work of the overall farming sector.

2.2 Literature Review

The literature review is a summary of the critical evaluation of previously completed work which, in the author's opinion, is relevant to the present study. It stands for the relationship of his/her study to other related prior investigations. In a research paper or journal article, the literature review is usually found between the problem statement and the description of the procedures. Its function is to look again (re + view) at the literature (i.e. the reports of what others have done) in a related area: an area not necessarily identical with but collateral and similar to your own area of study.

A review of the literature will show what other researchers have done, reveal studies relevant to the present one, reveal sources of data unknown but exist,

provide new ideas and approaches to the solution of the problem and finally place the present study in historical and associated perspectives in relation to earlier studies relevant to the problem.

Emphasis should be placed on areas of agreement between the results and the literature review to strengthen the credibility of the study. This is normally written in chapter two of a project work. Literature search and strategies for looking for specialized articles (the importance of key words for example) is paramount. Some of the modern methods used in literature search are the internet facilities such Google search engine and Wikipedia. Catalogue of books in the library can also help in literature search. Normally agricultural students are not used to the basics of taxonomy. This is something important, as most of the information generated in the biological sciences is directly linked to a species name. If a species name changes, as it normally happens in some areas (e.g. parasitology), the existing information on that species may be linked to another species name, different from the valid name in use. The literature can be categorized into 3 main classes, namely: primary, secondary and tertiary literature.

2.2.1 The Primary Literature

The original reports of prior scientific and technical investigations make up the bulk of the primary literature. Most of them are accounts of experiments undertaken with findings and conclusions. They include periodicals, research reports, conference proceedings, patents, standards, theses, dissertations, encyclopedias, unpublished works, short communication and verbal discussions. The primary literature helps a great deal on how to more properly organize the research work as it broadens the knowledge of the researcher on the study subject. The primary literature is mostly widely scattered, disconnected and unorganized. Though of vital importance, they are always difficult to locate and to apply. Therefore, to obtain relevant primary literature is itself the first bulk work of the researcher.

2.2.2 The Secondary Literature

The secondary literature is compiled from the primary sources and is arranged according to some definite plan. They represent a worked-over knowledge rather than new knowledge. They organize the primary literature in more convenient form. By their nature, they are often more widely available than the primary sources and in many cases, more self- sufficient. They are mostly indexing and abstracting services, reviews of progress, reference books, treaties, monographs or text- books. They repackage the information from the

primary literature and guide the researcher to the original document. They serve not only as repositories of digested facts but as bibliographical keys to the sources.

2.2.3 The Tertiary Literature

The tertiary literature does not carry subject knowledge at all. Their main function is to assist the researcher in using the primary and secondary sources. Tertiary literature include guides to the literature, list of research in progress, guides to organizations, lists of indexes and abstracting services, directories, yearbooks and bibliographies. Obtaining good and relevant tertiary literature leads the researcher to ways and means of obtaining the primary literature more easily. A review is like an essay and, therefore, must be organized, logically arranged and readable. The review should be presented in a simple and clear language; repetitions should be avoided.

Previous findings (both positive and negative) in the field should be highlighted, authors properly cited and areas of further research stressed. It is important to emphasize that, review should cover pertinent and relevant works of others only; authors that agree and those that do not on the subject matter should, if convenient, be grouped. A reviewer should use his own language and not transcribe someone else's language. Note that, a review entails a critical appraisal of articles, papers or subject matter not mere summaries. Information for your review may be obtained from journals; magazines; newspapers; textbooks; theses; monographs; bulletins and the internet. Always try to highlight the most current information on the subject matter. It is also good to search for very good old papers, that brought unedited ideas/concepts/results and which deserve citation, depending on the case.

2.3 Materials and Methods

Under materials and methods, as the name implies, the researcher tries to list and describe all the materials that were used during the research work from start to conclusion. He/she also describes the methodology employed in carrying out the project work. It is found in chapter three of the project work. It has the following sub-headings:

2.3.1 Description of the Study Area

This section starts with a brief description of the study area, mentioning the location of the area and its geographical characteristics, climate (rain fall,

temperature and humidity), type of vegetation, population of humans, livestock and its boundaries and neighboring areas. For example, a livestock study may be conducted in the guinea savannah zone of North Eastern Nigeria, taking Adamawa state as a case study. The researcher then may need to describe the study area as follows:

Adamawa is one of the six states which make up the North East geopolitical zone of Nigeria with Yola as its capital (Adebayo and Tukur, 1997; Adebayo, 1999). It shares an international boundary with the Republic of Cameroon to the east and interstate borders with Borno State to the north, Gombe State to the northwest and Taraba State to the west and south (Adebayo and Tukur, 1997; Adebayo, 1999). Adamawa State initially existed as part of the Northern Region in the three-region structure of 1954; it was then known as Adamawa Province. In 1967, the military government of General Yakubu Gowon created twelve federal states and Adamawa became part of North-Eastern State (Adebayo and Tukur, 1997; Adebayo, 1999). With the creation of nineteen states in 1976 by the military government of General Murtala Muhammed, Adamawa became part of Gongola State. In 1991, the military government of General Ibrahim Babangida divided Gongola State into Adamawa and Taraba states.

Adamawa State occupies an area of 38,823.3 square kilometers. It lies at latitude 9°20' North and longitude 12°30' East. It has minimum and maximum rainfall of 750 and 1050mm and an average minimum and maximum temperatures of 15^0c and 32^0c. The relative humidity ranges between 20% and 30%. The major vegetation is northern Guinea savannah (Adebayo and Tukur, 1997). The valleys of the Cameroon, Mandara and Adamawa mountains form part of its landscape. It has a population of 3,178,950, representing 2.3 percent of the Nigerian total population, and a population density of 82 people per square kilometer (Adebayo and Tukur, 1997; Adebayo, 1999). The Fulani are the original inhabitants of Adamawa State. The state derives its name from Modibbo Adama, a disciple of Usman Dan Fodio and the founder of the Adamawa Emirate. The emirate, which traces its origins back to 1809, is headquartered at Yola. The emirs are known by the traditional title of Baban-Lamido.

The main ethnic groups in the state are the Fulani, Quadoquado, Lala, Bwatiye, Chamba, Higgi, Mbula, Margi, Kilba, Ga'anda, Longuda, Kanakuru, Bille, Bura, Yandang, Yungur, Fali, Gude, Verre and Libo (Adebayo and Tukur, 1997; Adebayo, 1999). The dominant religions in Adamawa State are Islam and Christianity, although some of its inhabitants still practice traditional religions.

There are twenty-one Local Government Areas (LGAs) in the state as shown

in the map. The major occupation of Adamawa people is farming. Cash crops grown in the state include cotton and groundnuts, cowpea, benni seed, bambara groundnut, tiger nut, while food crops include maize, yam, cassava, guinea corn, millet and rice. The village communities living on the banks of rivers engage in fishing while the Fulani and other tribes who are not resident close to rivers rear livestock such as cattle, sheep, goats, donkeys, camels, horses and poultry (Adebayo and Tukur, 1997; Adebayo, 1999). The mineral resources found in the state include iron, lead, zinc and limestone.

Tertiary educational institutions in the state include: Modibbo Adama University of Technology, Yola, (former FUT Yola) and American University of Nigeria, Yola, Adamawa State University, Mubi, Federal Polytechnic, Mubi, and Federal College of Education, Yola. The state also has Adamawa State Polytechnic, Yola, School of Nursing and Midwifery, Yola, College of Education, Hong, College of Health Technology, Mubi, College of Agriculture, Ganye, two Vocational Training Schools and a College for Legal Studies all located in Yola. Tourism attractions in the state are: Kiri Dam, Koma Hills, Mandara Mountains, Shebshi Mountains, Sukur Cultural Landscape, Lamurde Hot Spring, Gashaka-Gumti National Park, Monuments and Museums, Modibbo Adama's Tomb. Annually, Adamawa plays and hosts 32 festivals, including the three-day Zhita in Bazza as well as Dukwa and Yawal in Madagali. There is also Sorro, a Fulani day-long observance commemorating the initiation of a group of young boys into manhood. It is held in Yola and usually takes place in February. The Kilba people of Hong are renowned for their Tiwe festival which runs for 120 days. It is a funerary rite which features sacrifices to ancestors, the pouring of libations, incantations and drumming, singing and dancing, as well as street processions. Festivals such as the Njuwa Fishing Festival, which holds at Lake Njuwa in Yola, the Yinagu Fishing Festival at Michika and the Farai wrestling festival in Demsa attract people from within and outside the state from the month of March through to May each year (Adebayo and Tukur, 1997; Adebayo, 1999).

2.3.2 Experimental Design

The choice of treatments, the method of assigning treatments to experimental units and arrangement of experimental units in various patterns to suit the requirement of particular problems and area, is known as the design of experiment or experimental design. The purpose of designing an experiment is to increase the precision of the experiment to reduce experimental error. Designing an experiment is a very important step to take because errors made in the design can invalidate the result of the entire study. It is wise to avoid complex experiments. Success normally comes when simple designs are used.

The most abled Statistician cannot help any researcher to reach and draw valid inference from a poorly designed experiment.

2.3.3 Steps to Follow in Conducting an Experiment

1) Always design an experiment paying close attention to the variability of the materials you intend to work with.
2) Apply the contrasting treatments and carry on with the experiment.
3) Make the necessary measurements or counts, such as yields, weights in grams etc.
4) Reduce the data to simple terms by calculating the means, standard deviation (SEM).
5) Make a Null hypothesis.
6) By deductive reasoning method, determine the probability to see if the differences observed would have been greater than those obtained if the Null hypothesis were true, that is P = 0.05, P = 0.01 or P = 0.001.
7) Decide whether to reject or accept the Null hypothesis. It is considered rejected and the observed differences considered significant, if the probability in (f) above is less to the previously decided number at 0.05 level.

2.3.4 Techniques of Experimental Design

To reduce error, a researcher adopts certain techniques which form the basic principles of experimental design. The basic techniques include: replication, randomization and local control.

(1) Replication

Replication means that a treatment is repeated two or more times. Its function is to provide an estimate of experimental error and provide a more precise measure of treatment effects. The number of replications that will be required in a particular experiment depends upon the magnitude of difference you wish to detect and the variability of the data you are working with. Considering these two things at the beginning of an experiment will save much frustration. An experiment with a single replication will give a poor measure of treatment effect.

(2) Randomization

Randomization is the assigning of treatments to experimental units so that all units considered have equal chance of receiving a treatment. It functions to assure unbiased estimates of treatment means and experimental error. The

researcher normally talks about chances and variation due to many factors that are unknown and beyond his control. Such factors may range from: Light intensity, genetic constitution, soil heterogeneity, temperature variation, disease infections, measurement errors, noise etc. that may affect the outcome of the experimental units. Such factors may change with time, location of the experimental field, liter size, and green house bench, location of animal pen or cage and weather conditions as influenced by season. A typical example of some extremes in randomization that can be misleading is feeding group of white Fulani breed of cattle with one type of ration (A) and Red Sokoto with another type of ration (B) in an attempt to measure daily weight gain using the two diets A and B.

(3) Local Control

This principle of experimental design allows for certain restrictions on randomization to reduce experimental error. For example, in the randomized complete block design, treatments are grouped into blocks that are expected to perform differently, allowing a block effect to be removed from the total variation in the trial.

2.3.5 Types of Experimental Designs

There are many types of experimental designs. These include the following:

1. Single factor experiment e.g. Completely Randomized Design (CRD), Completely Randomized Block Design (CRBD) and Latin Square Design (LSD).
2. Multifactor experiment e.g. factorial, split plot.

Completely Randomized Design is the basic single factor experiment. All other designs like CRBD, LSD are stemmed from it.

(1) Completely Randomized Design (CRD)

When treatments are arranged randomly over the whole of a previously determined set of experimental units, the design is known as Completely Randomized Design (CRD).

CRD is appropriate when the experimental material is homogenous. In field-experiments there are generally large variation among experimental plots due to soil heterogeneity. Hence CRBD is preferred in field experiments. In laboratory experiments and green house studies, it is easy to achieve homogeneity of experimental materials. Therefore, CRD is most useful in such experiments. It

has advantages of being flexible because any number of treatments and replications can be used and it is very easy to analyze even when replication is not the same for all treatments. The only disadvantage is that it is not most accurate due to absence of blocking.

(2) Completely Randomized Block Design (CRBD)

It is probably the most used and useful of the experimental designs. It takes advantage of grouping similar experimental units into blocks or replicates. The blocks of experimental units should be as uniform as possible. The purpose of grouping experimental units is to have the units in a block as uniform as possible so that the observed differences between treatments will be largely due to true differences between treatments. The randomization procedure is that, each replicate is randomized separately· Each treatment has the same probability of being assigned to a given experimental unit within a replicate. Each treatment must appear at least once per replicate.

Suppose the experimental material is divided into r blocks. Let there be t treatments. Each block is then divided into t units and the treatments are allotted within a block at random. The resulting design is called randomized block design or commonly known as Completely Randomized Block Design (CRBD). The advantages of CRBD are that, it measures and removes variability over an experimental area by maximizing differences between blocks and minimizing differences within blocks. It is, also, more precise than CRD due to presence of blocking. No restriction on the number of treatments or replicates. Some treatments may be replicated more times than others. Missing plots are easily estimated. Whole treatments or entire replicates may be deleted from the analysis. If experimental error is heterogeneous, valid comparisons can still be made. The disadvantages are that, blocking cannot remove variability under certain condition such as soil heterogeneity, unpredictable insect infestation and wind direction. Error, df, is smaller than that for the CRD (problem with a small number of treatments). If there is a large variation between experimental units within a block, a large error term may result (this may be due to too many treatments). If there are missing data, a CRBD experiment may be less efficient than a CRD. For example, given four fertilizer rates applied to rice and three replicates of each treatment.

Rep 1	Rep 2	Rep 3	
A	B	A	A=0 kg N/ha
D	A	B	B=50 kg N/ha
C	D	C	C=100 kg N/ha
B	C	D	D=150 kg N/ha

(3) Latin Square Design (LSD)

When the experimental material is divided into rows and columns and the treatments are allotted such that each treatment occurs only once in a row and once in a column, the design is called Latin Square Design (LSD). With Latin Square design a researcher is able to control variation in two directions. Treatments are arranged in rows and columns. Each row contains every treatment. Each column contains every treatment.

In LSD the number of rows and columns are equal. Hence, the arrangement will form a square. E.g. 3 by 3; 4 by 4; 5 by 5; 6 by 6; Latin Square etc. In LSD each row and column are a complete block or replication. Advantages of LSD are that, since treatments are equal by row and column, it is more efficient in controlling variability than CRBD as it can control source of variation by row and column. It can control variation in two directions. It is also a good design because it has some hidden replications. The disadvantages are that, actual number of treatments must be equal to the number of replications. It can't contain large number of treatments beyond 4 to 8. So it is not practicable to use the design when the number of treatments exceeds 4 to 8. The experimental error is likely to increase with the size of the square. Small squares have very few degrees of freedom for experimental error. It can't evaluate interactions between rows and columns, rows and treatments, columns and treatments.

Effect of the Size of the Square on Error Degrees of Freedom is given as:

SOV	Df	2x2	3x3	4x4	5x5	8x8
Rows	r-1	1	2	3	4	7
Columns	r-1	1	2	3	4	7
Treatments	r-1	1	2	3	4	7
Error	(r-1)(r-2)	0	2	6	12	42
Total	r^2 - 1	3	8	15	24	63

Where r = number of rows, columns, and treatments. One way to increase the Error df for small squares is to use more than one square in the experiment.

(4) Factorial Experiment

In this kind of experiment, two or more factors are studied at the same time. For example, if the behavior of a certain variable, say, variety or breed is observed to change with the effect of another variable, say, fertilizer, this behavior can be tested by using factorial design arrangement of treatments. Advantages of this kind of experiment are that, two experiments are performed

in one, interaction between two factors can be tested and there are some hidden replications which increases the level of precision. It broadens the scope of an experiment. It is possible to estimate the experimental effect. It is good for exploratory work where we wish to find the most important factor. Its disadvantages are that, it is complex. The experiment can become very large with the number of factors each at several levels.

(5) Split Plot Design

This is a kind of design used for treatments that are in factorial design or experiment where the precision of one factor is sacrificed for the other. The level of one factor is placed in the main plot, while the other is placed in the sub -plot. The one placed in the sub plot is more precisely measured than the one on the main plot, because soil variability within the sub plot is less than that of the main plot. Split plot design can be: I split plot, II split – split plot, III split – split – split plot.

(6) Covariance Analysis

This is an alternative means of analyzing data when the design used fails to detect or measure certain variability between or within blocks over an experimental area. It has the following uses in agricultural research: To control experimental errors and adjust treatment means, to aid in estimation of missing data and to aid in the interpretation of experimental results. Covariance analysis reduces variability by measuring an additional variable that is covariate X, when the number of insect incidence is linearly related to the primary variable Y. Then the source of variation associated with the covariate is deducted from the experimental error. Once this is done, the primary variable Y can be adjusted up or down.

(7) Incomplete Block Design

In theory, all the designs used in analyzing experimental results can carry any number of treatments. However, it so happens that there exist an inverse relationship between efficiency and the number of treatments. That is to say, as the number of treatments increase, then the efficiency of the design to detect error declines. Hence, with more number of treatments, the experimental error increases.

In order to avoid this, statisticians have devised another means and the device is to use incomplete block design. One of such designs is the Lattice Square Design and the most commonly used Lattice Square Design is the Balance Lattice Square Design (BLSD). The basic characteristic features of BLSD are that, the number of treatments must be a perfect square $t = k^2$, for example, 9, 16,

25, 49, 64, 81 and 100.

The number of replication must be 1 more than the block size, k + 1. For example the number of replication for 25 = 6, 9 =4, 16 = 5, 49 = 8 etc. and the block size k = √t.

2.3.6 Data Collection

Data collection follows questions like: What does the researcher use? What does he/she do and how? If it is a survey work, what method of sampling does the researcher employ? Does he/she use random or purposive sampling? Were questionnaires used? Where and how were socio-economic characteristics of respondents and the medicinal uses of some animal and plant parts obtained? How were the questionnaire drawn and administered? If it is a field experiment, is it a feeding trial? Were samples of feed taken to the laboratory for proximate analysis where ashes, moisture, nitrogen, crude protein, crude fibre, ether extract, dry matter, minerals and fats contents are obtained? Is it a blood or serum sample where hematological and hormonal parameters are measured? Is it a swap or faecal sample where bacteria and other parasites are to be isolated? Is it growing some crops where yield performance and disease resistance or susceptibility is measured? What design methods are employed? And so on and so forth. This is a simple section where a researcher only describes the materials he/she used, and the methods employed during the work. He/she does not need to interpret anything here. However, he/she must make sure he/she has described everything in detail. The important issue is to give enough detail about the methods used to allow other scientists assess the validity and accuracy of his/her results and be able to repeat the experiment to arrive at the same results. If a researcher used well-known methods, he/she should give their names and a reference to support his/her claim but if the researcher made any changes then these should be explained. You should be brief, but do not forget to mention important facts like sizes or volumes, number of treatments, replication, etc.

(1) The Diagnostic Phase in Research in Livestock Systems

To begin an agricultural research program, researchers need adequate knowledge of farmers farming conditions, cultivation and livestock keeping practices, the constraints faced and the development potential that is available. To this end information must be collected and analyzed, potential solutions must be identified, and research priorities must be set. This process of description, analysis and research planning is commonly referred to as diagnostic phase. Description, analysis, and research planning may be grouped

in several ways. Descriptive and diagnostic activities may include both the analysis of collected information and the development by researchers of hypothesis about problem areas and the identification of possible improvements. The diagnostic phase includes both the identification of constraints/potentials and the research planning phase in which constraints and opportunities are analyzed and research priorities determined.

Diagnosis should be an interactive process; it begins with an initial diagnosis but develops during the research process, as more information of farming systems becomes available. The emphasis of the cases presented in this guide is on the initial diagnostic phase, where the main objective is the identification of priority topics for the first cycle of on-farm research.

In addition to the identification of research topics, an initial diagnosis has other, less widely reorganized objectives. It should provide disciplinary or commodity research with new research questions. Based on the technology constraints faced by farmers and It should provide other, primarily, governmental institutions with policy-relevant information constraints and preconditions required for the promotion of agricultural development (such as extension and inputs). The selection of the target area may be based on a preliminary agro-ecological zonation carried out by the research team, but this information is usually made by government policy makers. When donor-supported programs are involved, donors also generally have a voice in the selection of the target area.

(2) Activities in Diagnostic Phase

As in other diagnostic studies, the sequence of information gathering for livestock studies generally begins with the collection and analysis of secondary data, followed by informal and formal surveys. The final step is the identification of constraints, possible solutions and prioritization of research topics. In this process, the specific tasks carried out in each step are strongly influenced by the results of the preceding step.

2.3.7 Secondary Information

Collection and analysis of secondary data should be the first step in a diagnostic study. In several case studies, fieldwork started without the analysis of secondary information. However, teams who did carry out this step get helped a great deal in defining what information needed to be collected during the informal survey. During a preliminary analysis based on secondary data, hypotheses about constraints and opportunities can be formulated. The informal survey can then be planned to test these hypotheses and to supplement the

available information. This provides a clear focus for the survey. Simply having team members read reports will not have the desired result. Teams will need to work together to analyze the available information. Generally, one to three weeks is required for secondary data collection and analysis, depending on how much prior work has been done to compile a bibliography on agriculture in the area (and livestock keeping in particular).

Adequate use should be made of secondary information. It is cheap, and using it encourages researchers to recognize and build upon work done in the past. Secondary information may come from regional and local institutions, as well as results for past research and development projects. Such information may provide general characteristics of the study area, including agricultural policies, socio-cultural information, agro-physical (climate, topography, soils), agro-biological (crops, livestock, their nutrition and diseases) and agro-economic (crop and livestock inputs and outputs, marketing) data: physical and institutional infrastructure, along with assessment of production problems and results of past livestock research. However, the reliability of secondary information and particularly of census data should be critically assessed.

2.3.8 Informal Surveys

Informal surveys can be used to confirm and complement the initial ‘systems understanding’ developed on the basis of the literature studies. Informal surveys are conducted using direct field observations and interviews with farm families and key informants (such as local leaders and traders). The main technique is the open-ended interview: researchers do not follow a set questionnaire, but may use checklists. Interview topics evolve as fieldwork progresses and as understanding of the farming system emerges. In recent years much emphasis has been placed on the involvement of farmers in identification of problems and solutions which has resulted in the development of participatory rapid appraisals. The findings of the informal survey should indicate whether or not a formal survey is needed; if the answer is yes, the information provided by the informal survey should make it possible to clearly state the objectives of the formal survey. In other words, the informal survey provides, in large measure, the research questions to be addressed in the formal survey.

(1) Characteristics of an Informal Survey

The aim of an informal livestock survey should be understanding, rather than data collection: understanding the role of livestock in the farming system, and understanding the dynamics and variability of livestock keeping. Dynamics and variability need to be understood not just in terms of animal productivity, but

also with respect to factors like animal husbandry practices, the importance of livestock for different types of households, and availability of forage.

(2) The Research Team

A multi-disciplinary team that works in an inter-disciplinary manner should be the norm. Many teams are narrow in composition or do not manage to get away from a narrow disciplinary focus. Minimally, an agronomist and a socio-economist should be part of any team carrying out a diagnostic livestock survey; a veterinarian and a person with broad knowledge of vegetation and soils are valuable additions. Arranging for the participation of extension workers and subject-matter specialists within the department of agriculture and the veterinary service is important. Not only can they provide an introduction to the village and share their knowledge of the area, but their inclusion also paves the way for obtaining their support for later work. In implementing on-farm trials and creating effective research-extension linkages, it is essential to have had such involvement from the very start of the research programme. The presence of women, including some older women, in the survey team is also important. Not only is their participation valuable, but also in many cultures women farmers will speak more freely in the absence of men. Further, women team members contribute their own specific knowledge of and interest in major components of the farming system. Participatory fieldwork techniques (mapping, transect walks, activity/resource calendars) and participatory discussion analysis sessions (such as joint writing, and analysis of constraints) may improve collaboration within the team. A skilled team leader is needed, however, to apply these techniques and foster inter-disciplinary cooperation.

If the results of the informal survey are to be valid, the people interviewed must be representative of those the project may want to involve. Several case studies show, however, a strong bias towards male cattle owners, often heads of households, in their choice of farmers to be interviewed by survey teams. This is not apt to provide good understanding of livestock keeping for these various categories of farmers to be interviewed. Women must be included in the discussions: they have specific information to provide. Also, they may have different viewpoints on these matters than men. Depending on the cultural context and the sensitivity of the points to be discussed, separate discussion groups may have to be formed during the survey for women and for men. Households headed by women often form a rather large group. They should not be overlooked, because their problems and possibilities in missing livestock may be quite different from those of male-headed households.

Among the others who should be specifically included in the interviews are

older farmers (both men and women), since they can give a picture of the developments in land use for the last decades, their causes and their impact (for example, on grassland availability). Herders, often young boys, are another interesting group. They are often better informed about the daily management and behavior of the animals than the owners, who are generally heads of households and less occupied with the daily care of their animals.

Households owning very few or no animals are rarely considered in livestock surveys. They do, however, form an important category because they can provide a clearer understanding of the role of livestock in the farming system (what are the differences in functioning between a household owning cattle and one having no cattle), and can improve the understanding of crop-livestock interactions. For newly established households, not having livestock may be a temporary situation. On the other hand, not all households that keep livestock are the owners of these animals. In most societies there are several types of lending arrangements.

A final category of people to seek out in the village is that of 'key informants'. These are people who can provide valuable information on a number of very specific points. Among those who might be considered key informants are village leaders, members of special village committees, the village extension worker, local butcher, traditional livestock healer, local livestock traders, and dip attendants. This list of possible discussion partners during fieldwork in the villages is not exhaustive, nor is it intended to suggest that all should be visited in every case. The survey team should determine which subjects to discuss with which categories of farmers. To allow time meet various categories of farmers, a stay of two to three days per village is recommended. This also allows the necessary flexibility in the programme: the strict time schedule necessitated by a one-day visit will not work and is not in line with the informal nature of the survey.

The contacts made during the informal survey can be a great help not only in collecting information but also in helping to ensure later implementation. By keeping people informed of progress of the study, a team can keep up their interest and commitment, which will eventually contribute to the adoption of any recommendations that emerge.

(3) Methods of Data Collection

Direct observation in the field combined with informal questions and discussion with farmers is the most basic method in any diagnostic study.

2.3.9 The Use of Checklist

The checklist, as used in an informal survey, is a guideline that allows open discussion with the person being interviewed, in search of interesting information on a number of major subjects. Checklists take the place of the questionnaires used for structured interviews. Discussion and probing is more important than a simple answer to a question posed by a team member. There is nothing new in this idea; however, experience shows that, it is often not easy to put into practice. The main reason is, probably, that most researchers and extension workers are more used to 'telling and asking' than to 'discussing arid listening, particularly with respect to farmers. To improve communication techniques during informal surveys and other interactions, training can be arranged to help team members learn to introduce the team in a village, make use of checklists in individual and group discussions, and combine direct observation with interviews. Since owners consider some information on animal production to be quite sensitive-such as livestock ownership, lending arrangements, and traditional veterinary practices-ways to deal with questions in these areas should be a point of particular attention. The list of points on which a team needs to search for information will be long. It will not be possible to deal with all the points in one single discussion, nor can good information on all of the various points be provided by a single category of farmers (e.g. cattle-owning men). This implies that, more than one checklist will be needed, and that farmers' representative of all of the potential target groups or recommendation domains should be included. Further, informal surveys should not be rigidly structured with respect to the sequence of activities, and should allow sufficient room for farmers to express their feelings, wishes, concerns, and hospitality, to pose questions, or to test the knowledge and skills of the 'livestock experts'. Allowing enough time for completing the informal survey can be an important part of the process, since careful exploration of farmer's questions and comments may provide information that is vital to the project.

2.3.10 Participatory Rapid Appraisal

A participatory rapid appraisal will combine several of the methods. The transect walk is a very valuable method in this respect: it involves a systematic walk through the area, seeing as much as possible of the variability in land use. This usually means one cuts across the topography, from hill tops to valley bottoms. It is helpful to have a few knowledgeable farmers accompany the group. During the walk, the team observes differences in land use, farming practices, relevant features for livestock keeping; informal discussions take place with the accompanying farmers and people met during the walk. To allow for maximum coverage (including a visit to sometimes distant grazing areas)

and facilitate informal meetings with farmers, the team may need to be divided into groups. These should be small and, as far as possible. Combining the results of transect walks, resource mapping, and flow charts provides a strong analytical tool. Linking charts to maps and transect diagrams makes it possible to visualize interactions.

2.3.11 Kraal Visits

Kraal visits (also referred to as animal biographies, herder recall, or in a somewhat narrower sense progeny histories) is one of the few tools used specifically in livestock systems diagnosis. The survey team visits a livestock kraal to observe and have informal talks with the owner (or keeper) and the herder, as the latter is likely to have more accurate information on aspects such as disease occurrence and livestock productivity. In this way the team can obtain an impression of livestock numbers, herd/flock composition, condition of animals, and livestock productivity. For example, to get an idea of productivity, one can ask about the performance of a few individual animals (age, number of offspring, age and condition of most recent offspring, milk yield). Although this does not give a 'precise' quantified picture, the information is valuable, and most likely will lead to new observations and questions. Kraal visits can be combined with transect walks.

2.3.12 Wealth Ranking

To obtain insight into wealth or socio-economic categories in a village, a wealth-ranking exercise can be conducted during participatory rapid appraisal. This allows the team to become aware of how attitudes, decision making, and production priorities are affected by wealth, and provides a basis for the identification of target groups for future research and development activities. Livestock ownership often plays a dominant role in wealth ranking. None of the case studies mentions the use of a wealth-ranking method; most cases different socio economic categories we distinguished by researcher categorization or by applying farmer categories a project had distinguished in earlier years.

2.3.13 Analysis of Data, Debriefing and Report Writing

Analysis of the information collected should not be put off until after fieldwork is finished; instead, this should be a continuous process. At the end of each day of fieldwork, team members should briefly discuss the findings: because the team usually splits into smaller groups while working in villages. These daily discussions are necessary to keep the whole team well informed. These evening meetings may seem tiresome, but they are important not just to

inform, but also to do some preliminary analysis, testing of the hypothesis, and answering the questions formulated at the beginning of the survey. This makes it possible to identify topics for which insufficient or contradictory information has been collected, and to briefly evaluate the functioning of the team and the use of survey tools. This enables the team to maintain a clear focus. Based on these discussions, the checklist can be adjusted and changes can be made in the programme for the subsequent days of fieldwork. If travel distances and fatigue make evening discussions infeasible, a team meeting lasting one full day is to be recommended, after the fieldwork in a village has been finished.

Writing the final analysis, including the identification of constraints and priority research topics, and discussing the need for a formal survey to verify or quantify some topics, is often left up to a very small group of people. This may lead to a final product of less than optimal quality, since it makes no use of the knowledge of most team members. It may even jeopardize future collaboration with both farmers and other important actors, such as the extension service workers: when they do not participate in the final analysis and priority setting for research, they are less apt to understand and be committed to the results. Involving the complete team in the final analysis is therefore strongly encouraged. Such participation of all team members can be enhanced by using techniques that make it easy to visualize the analysis. Use can be made of the maps, flow charts, and diagrams made during fieldwork.

It is preferable to think through the planning method to be used. Unfortunately, none of the models now available seem to completely meet the needs of projects; perhaps, they are not well enough understood, but also, as mentioned in the introduction, they often call for unrealistic quantification or expertise that is not available. The results of the analysis should be verified in debriefing meetings in the villages where the fieldwork has taken place. Debriefings should be well-prepared meetings where survey findings are discussed with farmers. If the team decides to conduct on-farm trials in these villages, such meetings can also be successfully used to plan the first trials. When survey findings and proposals for future action are to be presented to district or regional institutions, small one-day workshops have proved to be particularly valuable. When the time comes to produce a survey report, teams often find writing a difficult exercise. It is time consuming, few of the team members are generally seen as good writers, and the written product does not always sufficiently reflect the information collected. A well-structured analysis of survey findings can facilitate writing the report, since many of the essential topics will already have been thoroughly discussed, and a structure will have been developed that can also be used in writing the final chapters, including the

analysis and identification of research priorities.

2.3.14 Duration

An informal survey in one agro-ecological zone, which takes into account the issues discussed here, will take 14 to 16 weeks. This assumes a team of moderate size (ten persons), which visits three to five villages, staying in each one for two or three days. Survey preparations take two to four weeks, fieldwork takes three to five weeks; team analysis, debriefings and a one-day workshop require three weeks, and report writing needs three to four weeks (assuming that some reporting is done during the analysis).

(1) Formal Surveys

Formal surveys, provide a quantitative basis for conclusions drawn during earlier phases, but could also be used to redefine target groups (or recommendation domains), and to test hypothesis about relationships. The main technique is the structured interview, using a questionnaire. The survey may be carried out during one or more visits. Multiple visits may take place at irregular or regular intervals; herd monitoring to collect data on livestock productivity parameters, for example, can best be done with regular visits.

Formal surveys impose relatively high financial, time, and manpower requirements, they should, therefore, only be carried out when the outcome of an informal survey indicates a need for further research. Before embarking on extensive data collection, it is useful for researchers to ask themselves the following questions: What is the purpose of the survey? What are the types of data that can be collected consistent with this purpose? Are the methods to be used to collect data appropriate to the circumstances and the type of data required? The concluding question is, whether the costs of carrying out an extensive formal survey are matched by sufficient benefits.

(2) Research Planning

It is vital to plan based on careful analysis of the survey results. This is done during the research planning process, a critical part of the research process that often receives insufficient attention. Research planning, including the identification of research priorities, is based on a series of steps which correspond roughly with the terms problems (what is wrong), causes (why) and solutions (what can be done), followed by ranking of the problems and solutions. As the number of problems exceeds the research capacity of the team, problems must be ranked according to relative importance. Criteria usually used include, how many farmers does the problem affects? How frequently does it occur?

What loss in yield or income does it cause?

Before examining possible solutions, the interactions among problems and causes (biophysical, socioeconomic or cultural) need to be examined. Potential solutions should then be sought for problems for which the probable causes are understood. Potential solutions may come from past research or from research results reported in the literature. It is very important for the research team to listen carefully to farmers who can provide essential local knowledge regarding the feasibility of potential solutions. As for problems, it is necessary to rank and evaluate potential solutions and how much time and other resources would be required to test potential solutions. Finally, priorities for research must be set, based on the earlier analysis of problems and solutions. In fact, priority setting is a complex process, because of the many actors who need to be involved. Problems and solutions are often diverse; varying in complexity, level, and extent to which they can be quantified and different actors may have very different ideas about them. A partial solution is to divide problems and solutions into groups and prioritize them into these groups, for example, livestock problems and crop-related problems but consensus will remain an essential part of the process. Agreement is needed on operational definitions for project objectives, on criteria, and on the relative importance of criteria. Further development of methodologies for priority setting is needed, including ways to involve farmers. To date, the planning techniques afore mentioned have been primarily used by researchers.

(3) Research Methods and Tools

In the course of the research process, beginning with the initial diagnostic studies, information is collected and analyzed, and decisions are made regarding the research priorities. The research methods and tools to be used must be selected to match the situation. In choosing methods, the reliability of the data collected and whether data will be available at the appropriate time are important considerations, but many other factors also play a role. Two significant factors discussed below are farmer participation and the need to adopt research methodology according to the resource of national search programmes.

(4) Farmer Participation

Farmers frequently participate in diagnosis as survey respondents but instances of farmer-researcher collaboration have been limited. There is often a sort of doctor-patient relationship; researchers consult farmers, diagnose their problems, and try to find solutions. Nevertheless, in recent years substantial efforts have been made to increase participation of farmers in the research

process. They are no longer seen as simply a source of information, but are consulted and increasingly involved in decision making about research priorities, trial design, implementation, and evaluation. This has important consequences for the choice of research methodologies. For example, in the diagnostic phase, the emphasis has changed from formal to informal surveys, in which participatory rural appraisals are an important component. Few of these methods apply only to animal production: most are applicable to other farm enterprises as well. However, even far better developed participatory rapid appraisal methods cannot fully replace more conventional formal survey methods. Where more detailed quantified information is required, formal surveys may still be the most suitable.

(5) Adapting Research Methodology

Research methodologies should be adapted to suit the resources and expertise available in national research programs. This also suggests a careful look at how quantitative the data collected need to be. In most African countries, financial resources for research are very scarce, producing a realistic and useful analysis and identifying research priorities does not require knowing everything about a farming system or its livestock component. In livestock research, there is still scope for evolving appropriate methods that are cost-efficient and based on defining the key information and degree of understanding required. Although participatory research can be expensive especially in terms of time commitment for researchers and clients, its use in the diagnostic phase is likely to be less expensive than diagnostic studies based on formal surveys. Good communication forms the basis for participatory research. This and other facets of participatory diagnostic methods require particular skills: training will be needed for researchers, extension workers, and other members of the survey team. A good attitude towards working with farmers is also essential.

At this point, it is probably clear that no one combination of methods and tool can always be applied in diagnostic livestock studies. And, in addition to the important factors that have been discussed, others, such as the time available for the study and the size and heterogeneity of the study area, have not been dealt with. In addition to skilled, experienced researchers, methods for creating this linkage will need to be developed in all of these areas. There is still room to develop and adopt new diagnostic methods and tools for livestock systems search.

2.3.15 Statistical Analysis

This is defined as the refinement and manipulation of data in order to prepare

them for the application of logical inference. Statistical analysis is divided into descriptive and inferential statistics. Descriptive statistics is used in research for the purposes of bringing the data into order i.e. data preparation, tabulation and summarization which could either be qualitative or quantitative. Frequency distribution and percentages, histogram, frequency polygon, ogive, percentiles and averages are used in descriptive statistics.

2.3.16 Data Analysis

Data is defined as quantitative information in its raw form. Analysis may be defined as breaking down and ordering of the quantitative information gathered through research or some other means of data gathering. It involves searching for trends and patterns of associations and relationships among these data. Data generated can be subjected to statistical test to tell whether a variable has an effect on something. It can also reveal the relationships, correlations and interactions of two or more parameters or characters. The statistical techniques usually used in the analysis of data for agricultural based researches include: ANOVA, Chi-Square and T-test, Correlation, Regression etc. At times, simple descriptive statistics such as percentages, frequencies and averages are also used to express the level of effect, incidence, prevalence and frequency of occurrences of something. A researcher should also know how and when to use SD, SE, SED, r and r^2 values.

2.4 Results and Discussion

The results basically deal with what happened in your experiment, that is the new findings and discoveries form the researcher's results. It is usually presented in chapter four of the project work. Results may be presented making no comments on them. The interpretation is later given in the discussion section. Interpretation is the explanation of the association and relationships found among the data or groups of data. This also may include inferences and conclusions drawn from these relationships discovered among the data or groups of data.

Another approach is to interpret the results up to a point to make some connections between the different statements, such as the significant levels ($P<0.01$ or $P<0.05$) or not significant ($P>0.05$) and the correlation levels (positive or negative etc.) but give more detail in a separate discussion section. However, the basis of research is the ability of the researcher to design, conduct experiment, collect data, analyze the data, interpret the results, discuss, conclude and make recommendations for implementation.

A third way is to combine the results with a discussion of each point. This last method will work best in a short and simple experiment. It is usually easier to follow the results if the researcher presents them in the same order as he/she gave the objectives in the introduction. Well-presented results are simply and clearly stated and reports representative data rather than endlessly repetitive data, reduce, large masses of data to means or averages, along with the standard error or standard deviation. Report repetitive data in tables and graphs, not in the text, repeat in the text only the most important findings shown in tables and graphs. Include negative data, which is what was not found, if they affect the interpretation of the results and give only data that relate to the subject of the work as defined in the introduction. Refer in the text to every table and figure by number; include only tables, figures and graphs that are necessary, clear and worth reproducing. Avoid repetition of data, unnecessary negative data, unnecessary figures or graphs, unnecessary words. Under this section, a researcher may present all the relevant results in this manner:

2.4.1 Presentation of the Results Using Tables or Figures

The results determine the mode of presentation (that is either to use Tables or Figures). Tables are systematic arrangement of data or information in a format that allows the reader to easily observe variations or trends and make comparisons. Data that have been collected and analyzed in a scientific investigation are presented in the Results section. These data represent the research findings and may be presented as tables. Tables are good for presenting precise numerical data. When making comparison of treatments, tables are better used, especially where the exact value is important and since the final values from these should appear close together. Tables are prepared or drawn in rows and columns with titles, column and headings on top of the tables. Some tables contain footnotes at the bottom. Some schools and journal companies allow the use of vertical and horizontal lines within the tables while others do not allow those vertical and horizontal lines apart from the two horizontal lines that separate the titles and sub-titles and the bottom horizontal lines that separate the data with the keys or legends. Tables are numbered 1, 2 and 3 etc. for self-explanation. When preparing tables, the titles should be in sentence case or most often in title case format.

Illustrations or figures are visual patterns used to present information or data. They are frequently used in presenting research data because they present information in a way that is easy to read and understand. Illustrations are often referred to as figures which are meant to present data vividly; they must be simple and clear with relevant legends so that readers can immediately get the message. The major advantage of illustrations is that they present information in

a form which otherwise would need many words to explain. Remember the old saying, 'A picture is worth a thousand words'.

Line graphs demonstrate relationships among data or dynamic comparisons. Graphs are best for illustrating trends and relationships among sets of variables. If the researcher is showing trends or gross changes then a graph will have the most effect. Do not use graphs to duplicate information already in the tables or text. Bar and pictorial graphs compare quantities. Pie charts show proportions of a whole. Photographs are accurate representations taken with a camera. They give vivid evidence of research findings. Describe the overall results and not each individual values. Flow charts show a complicated process or system. Maps may show the distribution of quantitative or qualitative data or illustrate research sites or other locales. Line drawings illustrate objects, specimens or represent data. A researcher should not ignore Tables and Figures and their units of measurements. A researcher should make sure he/she mentions every one of them in the text. Preferably every table, graph, photograph and figure is on a separate page. These are usually presented after references at the last page of the work. But, this again, depends on the particular institution and journal because some allow presentation of tables and figures in the text together with results and discussion.

Examples of tables and Figures:

Table 1. *Comparison of the Physico-Chemical Characteristics of Otamiri River, Imo State, Nigeria Treated with Alum and 2 Gram/10 Liters of some Tropical Plant Seeds for 1 Hour.*

Parameters	WHO STD	Raw Sample	Alum Treated	MOT 2g/1hr	ABT 2g/1hr	ZMT 2g/1hr	TTT 2g/1hr
Temperature	20-30	23.0	22.3	20.0	21.3	21.3	21.7
pH	6.5-8.5	5.24	3.66	4.77	5.12	4.86	4.98
TDS (MG/L)	250	61	61	60	48	58	44
TSS (mg/l)	50	32	16	38	18	24	23
Color (PLCO)	15	44	33	128	89	131	119
Turbidity (NTU)	50	58	20	50	40	39	41
Appearance	Clear	Clear	Clear	Milky	Slightly Clear	Slightly Clear	Slightly Clear
Odor	Odorless	Odorless	Odorless	Odorless	Odorless	Slight Odor	Slight Odor
Taste	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless
Nitrate (mg/l)	40	0.2	0.1	0.2	0.2	0.1	0.2
Iron (mg/l)	1.0	0.70	0.67	0.21	0.01	0.09	0.05
Copper (mg/l)	0.3	0.00	0.13	0.10	0.03	0.06	0.03
Conductivity	100	122	122	120	97	119	87

Table 2. *Comparison of the Physico-Chemical Characteristics of Otamiri River, Imo State, Nigeria Treated with Alum and 2 Gram/10 Liters of some Tropical Plant Seeds for 24 Hours.*

Parameters	WHO STD	Raw Sample	Alum Treated	MOT 2g/24hrs	ZMT 2g/24hrs	ABT 2g/24hrs	TTT 2g/24hrs
Temperature	20-30	23.0	22.3	22.9	23.0	22.8	22.9
pH	6.5-8.5	5.24	3.66	4.83	5.15	5.13	5.05
TDS (MG/L)	250	61	61	43	34	34	34
TSS (mg/l)	50	32	16	10	26	35	41
Color (PLCO)	15	44	33	84	139	150	165
Turbidity (NTU)	50	58	20	18	48	57	38
Appearance	Clear	Clear	Clear	Clear	Slightly Clear	Slightly Clear	Slightly Clear
Odor	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless
Taste	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless
Nitrate (mg/l)	40	0.2	0.1	0.1	0.2	0.4	0.2
Iron (mg/l)	1.0	0.70	0.67	0.07	0.0	0.13	0.29
Copper (mg/l)	0.3	0.00	0.13	0.14	0.03	0.09	0.07
Conductivity	100	122	122	85	67	68	67

Table 3. *Progesterone Concentration of Non-cyclic RB (ng/ml) in Adamawa State, Nigeria.*

Weeks	*Mean*	*SE M*	
1	22.800	0.2757	1 VS 2 ns P>0.05
2	23.000	0.1826	1 VS 3 * P<0.05
3	23.700	0.2556	2 VS 3 ns P>0.05

Figure 1. *The Use of Oxen for Pre - and Post-Emergence Weeding of Farm Lands in North Eastern Nigeria.*

Figure 2. *Natural Calf Rearing in Lala District, Gombi Local Government Area, Adamawa State, Nigeria.*

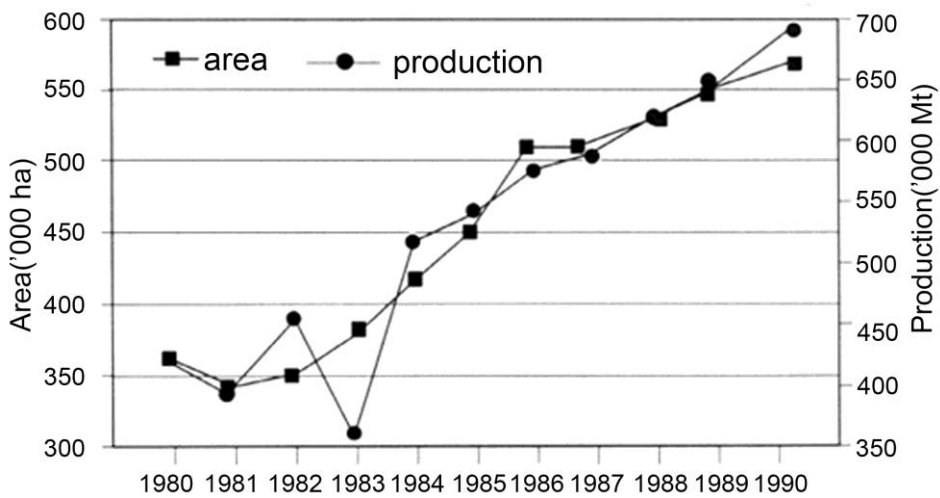

Figure 3. *Line Graphs Illustrating Relationships and Making Comparisons between Rice Production and Land Area in Côte d'Ivoire.*

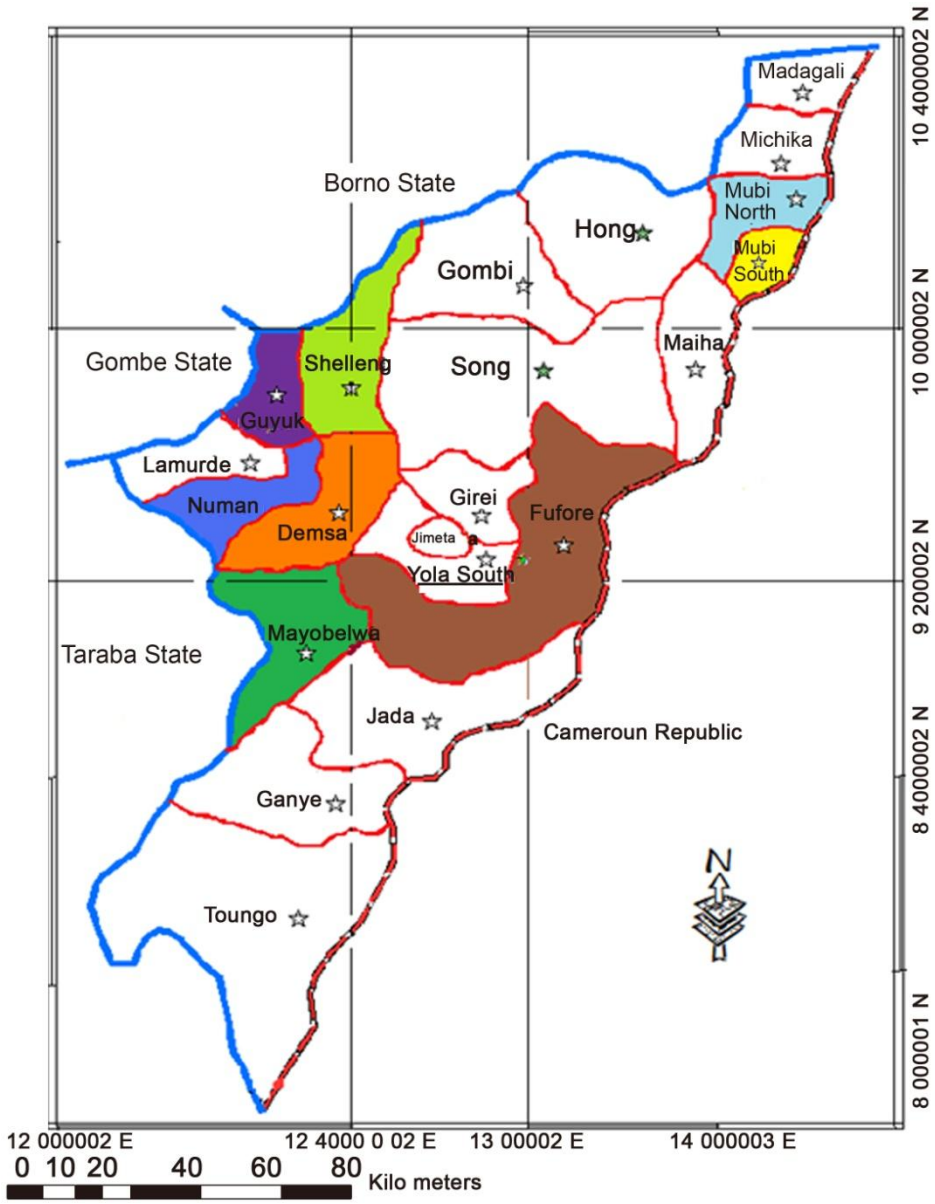

Figure 4. *Map of Adamawa State Showing the 1 3 Uncoloured Local Government Councils as Study Areas.*

2.4.2 Discussion

In the discussion section, a researcher must answer questions such as: What do my results mean? And what are their implications? This is the most important and demanding section of the work. A researcher must interpret his/her results for the readers so that they can understand the meaning of his/her findings. There must be clear relationship drawn to previous works. Here, a researcher can discuss why some things happened and why some things did not happen and the variation seen in his/her results in relation to others. A researcher can, also, discuss the relevance of his/her research work to the specific fields; point out how it relates to other fields and make recommendations from his/her work and point out possible avenues of further research. The researcher should relate his/her findings to previous work and if they do not agree with his/her work then consider and tell the reasons why. Tell readers the significance of the study to members of the community or to other researchers. The researcher should make sure that he/she deals with each of the originally stated objectives and follow the order of original objectives. The discussion section has three parts:

a. The facts a researcher has found or discovered;
b. His/her commentary on the facts, and
c. The theoretical implementation of the facts.

2.5 Summary

This section clearly summarizes the important findings of the study. It should be brief but contain the results presented and possibly the significance of the results and its interpretation. Summary of a research work titled: *Rainwater Harnessing and Harvesting for Domestic and Agricultural Purposes in Nigeria* should take this form: The results show that 80% of respondents had sufficient rainwater while 20% had mixed reactions in terms of sufficiency of harvested rainwater for domestic and agricultural uses. It was also observed that, most times, the rains fall when members of some families were still at their farms and so could not have the opportunity to harvest and store rainwater on every rainy day. The results also show that 90% of the respondents use rainwater for domestic chores with only 10% using the first dirty rainwater collected to irrigate small backyard vegetable gardens, banana, pawpaw and oranges that are usually planted within the compounds near where clay water pots are kept. Average temperatures for each of the three months were 27, 25 and 26^{o}C respectively. The Colour had 5, 5 and 5 values. Turbidity was 0.15, 0.16 and 0.15, P^{H} Value was 6.9, 6.9 and 6.7, Chlorine had 0.1, 0.1 and 0.2 and Chloride

was 16, 14 and 18. Free CO_2 were 8, 9 and 10, total Acidity were 8, 11 and 14 and total Hardness were 19, 14 and 12. Calcium Hardness were 12, 8 and 6, Magnesium Hardness were 35, 30 and 25, Alkalinity were 14, 26 and 30, and Nitrate were 19, 18 and 20.

This summary usually comes under chapter five of the project work or thesis together with conclusion and recommendations.

2.6 Conclusion

If a researcher's results and subsequent discussion have been especially complicated, it may be useful in conclusion to bring all his/her findings together in consolidated whole with clear inferences drawn.

Example I: Conclusion of a research work titled: *Rainwater Harnessing and Harvesting for Domestic and Agricultural Purposes in Nigeria* should take this form: Rainwater harnessing, harvesting and storing was found to be a simple low-cost technique that can do much to alleviate water shortages in areas where pipe borne water is unavailable, expensive or unreliable. Yet in Nigeria it is often overlooked as a strategy, partly due to lack of information, orientation, awareness and laziness.

Example 2: Conclusion of a research work titled: Incidence of Repeat Breeding Syndrome in Cattle Herds in Four Selected Local Government Areas of Adamawa State: It was concluded that, the incidence of repeat breeding syndrome is a worldwide phenomenon and has led to a huge economic waste in the cattle industry in these areas since the animals had repeated services with wide calving intervals, reduced milk production and increased culling rates. The animals had normal reproductive tracts with normal progesterone concentration which could have not influenced the repeat breeding syndrome. Therefore, since Repeat Breeding syndrome is a multi-factorial condition, the possible risk factors could be poor management, season, error in heat detection, wrong time of service and other environmental imperfects. It is not justifiable to cull the animals from the herds because most of them are not sterile but have lowered fertility.

Example 3: Conclusion of a review article titled: Current Approaches to the Determination of Feed Intake and Digestibility in Ruminant Animals: Since evaluation of preferred forage will continue to be important in grazing lands development, it is necessary to spatially separate the forages being evaluated to eliminate the constraints that occur within an intimately mixed sward. This is

most critical for researchers in regions which are trying to move from traditional extensive pastoral practices to some form of semi-sedentary production of ruminants under a managed field. As these reviewed novel approaches continue to evolve, it is expected that they will become simplified and cost effective and, therefore, find wider applications in agriculture and diagnostic research.

2.7 Recommendations

This section tries to highlight unanswered questions and recommend for further investigation. It also provides suggestions which when adhered to will provide solutions to the discovered problem. This section also states how the results of this study may be implemented or utilized by the relevant/concerned community, governments, agencies, organizations or institutions.

Example 1: Recommendations of a conducted research work titled: *Rainwater Harnessing and Harvesting for Domestic and Agricultural Purposes in Nigeria*: It was recommended that, people should be given orientation and awareness on how to tap and harvest richly from nature, the need and the importance of rainwater for domestic and agricultural purposes throughout dry seasons. Any surface or paved areas can be treated as catchments. Even the footpaths and roads can act as catchments as these areas too receive the direct rainfall. Rooftops are the best among them because of the large coefficient of run off generated from them and there are low chances of water contamination. Conveyance system includes rain gutters and down pipes which collects the rain water from catchments to the storage tank. They need to be designed appropriately as to avoid the loss of water during the conveyance process. In those areas which receive rainfall frequently, their storage systems could be constructed to meet the daily water requirements. One should make sure that the storage system is properly sealed and does not leak. Use Chlorine from time to time to keep the water clean. Storage tanks should be covered to prevent mosquito breeding and to reduce evaporation losses, contamination and algal growth.

Example 2: Recommendations of a conducted research work titled: *Incidence of Repeat Breeding Syndrome in Cattle Herds in Four Selected Local Government Areas of Adamawa State* are written as: It was recommended that, to identify repeat breeder animals, two things are needed: good records and good heat detection. On many farms the efficiency of estrous detection is less than 60%, i.e. for every 10 animals potentially cycling only 6 are served. However, if done well they allow the farmer or herdsperson to pick up animals that are cycling normally but not getting pregnant or most importantly those not

fitting a normal pattern. Using this information, these possible problem animals can be identified quickly, subjected to veterinary examination and a treatment protocol applied. This reduces the potential days open and so saves money. Good records have two values. First, they need to be referred to easily and quickly. A notebook or breeding calendar is often better than a computer as a means of reference or "action list", as it is usually nearer to the animals. Good heat detection needs an ability to recognize the signs of heat and time set aside to look carefully for these as in some cases they may not be very obvious.

The 3-week calendar can be very useful in pinpointing likely candidates. Other aids, such as beacons, tail paint pedometers and milk progesterone can also improve heat detection but there is still no really cost effective substitute for the astute observer apart from the bull. If only the repeat breeders and other animals with reproductive problems can be identified, there could be treatment and preventive measures taken. If regular veterinary fertility visits are not used, then animals that have had three services and are not pregnant should be checked before serving again. Many studies have shown that the treatment of repeat breeder cows, even those that are apparently normal, does save money. They also show that it is those farms with good records and good breeding plans that save the most as they use the veterinary input most efficiently. The management and treatment of repeat breeders should form a significant part of the fertility section of your herd health plan. To prevent repeat breeding syndrome in cattle; ensure you are serving animals at the correct time. This means that all staff should know the signs of heat. Milk progesterone testing is also useful; animals in a true heat will have very low progesterone. Ensure insemination techniques are as good as possible. This is, particularly, important if you use A.I., do not serve animals previously diagnosed as pregnant without doing a cow – side progesterone test to confirm it has low progesterone and is not pregnant. If the animal is pregnant, A.I. may cause foetal loss. Identify and treat cows with whites before starting to serve them. Don't start serving too soon after calving. Herds that start early have lower pregnancy rates to service and so more repeat breeder cows. Minimize stress at service. For example, try and avoid serving around turnout or when changing the diet. Therapeutic use of GnRH and PGF2α for repeat breeders is recommended for improvement in pregnancy rate.

2.8 Arrangement of Chapters in Project Writing

(1) Chapter One: Introduction

1.1 Background of the Study.

1.2 Statement of the Problem.
1.3 General Objectives of the Study.
1.4 Specific Objectives of the Study.
1.5 Scope of the study.
1.6 Justification of the Study.

(2) Chapter Two: Review of Literature

2.1 Brief historical background.
2.2 Related research works done by other people, etc.

(3) Chapter Three: Materials and Methods

3.1 Location of the Study Area.
3.2 Experimental Design.
3.3 Data Collection.
3.4 Data Analysis.

(4) Chapter Four: Results and Discussion

Table 1: Systematic presentation of results based on how they were conducted or obtained and discussing them in comparison to other reported findings, etc.

Table 2: Some aspect of the results based on parameters measured, etc.

(5) Chapter Five: Summary, Conclusion and Recommendations

5.1 Summary.
5.2 Conclusion.
5.3 Recommendations.