

**INDIGENOUS KNOWLEDGE IN SELECTION FOR BREEDING LONGHORN  
ANKOLE CATTLE IN WESTERN TANZANIA**



**BY**

**FOR REFERENCE  
ONLY**

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE  
REQUIREMENTS FOR THE DEGREE OF MASTER OF ART RURAL  
DEVELOPMENT OF SOKOINE UNIVERSITY OF AGRICULTURE.**

**MOROGORO, TANZANIA**

**2006**

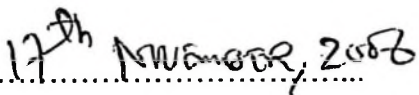
## ABSTRACT

For decades pastoralists in Western Tanzania have been using indigenous knowledge in selection for breeding longhorn Ankole cattle. Indigenous knowledge in breeding Ankole cattle has not been documented regardless of the fact that its existence is acknowledged worldwide. This study interviewed 60 Ankole cattle keepers and conducted village level workshops in order to document the traditional lifestyle of Ankole cattle keepers, indigenous knowledge concerning animal husbandry practices and potential of the Ankole breed. Furthermore, the study conducted a hypothetical experiment with 111 Ankole cattle owners to determine traits (animal profile) preferred by Ankole cattle keepers for qualifying animals for breeding. The study revealed that, 95% of Ankole cattle keepers in Western Tanzania are still pastoralists. Further the study revealed that the pastoralists had Ankole cows producing more milk (6.9 litres/day at average) compared to other indigenous cattle breed in East Africa producing 3.1litres/day at average. The study also found that Ankole bulls are determinants for phenotypic expression and performances of herds. Hypothetical choice experiment results revealed that, there are specific combinations of traits preference for breeding stocks used in selection for breeding long horned Ankole cattle. The combined traits qualifying animal as a breeding bull are: long white horns, dark red coat colour, large body size, docile and in line with high milk yield ancestors. For cows, the best combination of traits involves high milk yield (above 4litres/day) and high fecundity (yearly calving after puberty). Hence the recommendations from the study focus on the right combination between indigenous knowledge and formal knowledge aiming at improving performances and conservation of unique Ankole cattle breed not only in Western Tanzania but also, in other places where Ankole cattle breed is found.

DECLARATION

I, Noely Byamungu, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is the results of my own origin work and has never been submitted nor concurrently being submitted for a degree award in any other University.

Signature: .....

Date: .....

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## ACKNOWLEDGEMENTS

The successful completion of this dissertation has been achieved through valuable assistance of several individuals who often went beyond the call of their duty to come to me assist kindly and patiently so as to make this dissertation a successful work.

I therefore wish to express my heartfelt gratitude to the following individuals who made this study a success Dr Okeyo, M.A. (International Livestock Research Institute-Nairobi) and Dr Sendaro E. (Ministry of Livestock Development-Tanzania) for their tireless assistance, kind support and guidance during my research work. Acknowledgement is extended to Dr Wurzinger M. and Prof Soelkner J. (BOKU University-Austria) for preparing tools for data collection and for technical analysis of data.

Sincere gratitude goes to my supervisors, Prof. P. Gwakisa and Prof. D.S Kapinga for their hands-on, challenging and calculated guidance throughout the writing of this study. To both I say thank you for the valuable academic gifts that were vital for the completion of this dissertation.

I wish to acknowledge the financial assistance of the International Livestock Research Institute-Nairobi through its Graduate Fellowship program for this research work. This great support is highly appreciated.

I am thankful to the Lord my God who blesses with His will and Power that made me do and finish this work. I say thank you to the Almighty God.

**DEDICATION**

This work is dedicated to my parents for educating me despite the limited resources at their disposal, family members and sincere friends for their encouragement and prayers throughout my studies.

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**LIST OF ABBREVIATION**

CBPP	-	Contagious Bovine Pleural Pneumonia
ECF	-	East Coast Fever
FAO	-	Food and Agriculture Organisation
FMD	-	Foot and Mouth Disease
GDP	-	Gross Domestic Product
ILRI	-	International Livestock Research Institute
IRRI	-	International Rice Research Institute
MAFS	-	Ministry of Agriculture and Food Security
URT	-	Ministry of Water and Livestock Development
PRA	-	Participatory Rural Appraisal
SUA	-	Sokoine University of Agriculture
TSHZ	-	Tanzania Short Horn Zebu
UN	-	United Nations
URT	-	United Republic of Tanzania
USD	-	United State Dollar

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background situation

The livestock sector in Tanzania comprises of 18.5 million cattle, 13.1 million goats, 3.5 million sheep, 30 million indigenous chicken and about 3.5 million pigs. Livestock development is one of the sectors that are expected to make a significant contribution to the National Strategy for Growth and Poverty Reduction (URT, 2005). Furthermore, livestock is an important source of protein, food and cash income to many people. Livestock provide employment to millions of people especially in rural areas. It is estimated that over 90% of agricultural households in Tanzania keep livestock of some kind (MAFS, 1999). At present, Tanzania livestock sector contributes about 30% of agricultural GDP and 6.1% of the national GDP (URT, 2004)

Among the livestock species, cattle are the most important followed in decreasing order of importance, by goats, chickens, sheep and pigs. Cattle provide almost all the milk and 53% of meat consumed in the country (URT, 2004). Out of a total of 18.5 million cattle, 95% are indigenous. The indigenous breeds are the Tanzania short horn Zebu (TSHZ) and long horned Ankole cattle. The TSHZ are widely spread in the country while the Ankole cattle are found in Kagera and Kigoma regions and in some parts of Tabora and Rukwa regions (South West Tanzania).

The traditional Ankole cattle are the Sanga, which resulted from interbreeding of the Longhorn-, Shorthorn- taurine and zebu type cattle, commencing about 3000 to 4000 years ago (Payne and Wilson, 1999; DAGRIS, 2006). The original animals are thought to have

been brought to East Africa by Hamitic tribes migrating from north-eastern Africa and possibly the Sahel in the 13<sup>th</sup> and 15<sup>th</sup> centuries (Rege and Tawah, 1999. DAGRIS, 2006). In Uganda, the Nkole tribe's Sanga variety is known as the Ankole. In Rwanda and Burundi, the Tutsi tribe's Sanga variety is called the Watusi. In Tanzania, Wanyambo, Wahima, and Tutsi also Waha tribe's Sanga variety is named as Enyambo. (DAGRIS, 2006). Today Ankole cattle are distributed mostly from Lake Albert in Uganda to Lake Tanganyika in western Tanzania. Traditionally, Ankole cattle were considered sacred, as they are associated almost universally with birth, death, and marriage ceremonies, are the chief form of wealth, the most prominent measure of power, prestige, and status, and the proper animals for feast or ceremonies (Jstor, 2006). Additionally, their keepers adore them because of their distinctive feature "beauty". Ankole cattle have characteristically long and large horns are large to medium in body size; with solid dark red and various coat colour patterns and are polite animals at walking and milking (Wurzinger *et al.*, 2005a). Ankole cattle also better milkers than other indigenous breeds such as TSHZ, Nganda, Teso and Kalamajong (Kiwuwa, 2001).

In order to improve the productivity of indigenous breeds in developing countries, different cattle improvement programmes and strategies based on developed countries models have been attempted, but very often failed or proved impracticable (ILRI, 2004). The causes for such failure are numerous, but failures are often due to lack of suitability and adaptability of exotic breeds to local production systems or environment. On the other hand, cattle breeding models from developed countries do not fully meet the interest of local cattle keepers. Experience shows that, breeding goals do not take into consideration the non-tangible values of the indigenous cattle breeds (Kouado *et al.*, 2003).

Furthermore, genetic improvement through crossbreeding and upgrading can if poorly executed, lead to replacement of well-adapted local animals with potentially high producing but less adapted animals. Additionally it increases production costs that are often unaffordable to many poor livestock keepers.

## 1.2 Statement of the problem

Tutsi and Wanyambo tribes of Tanzania have a strong cultural attachment to their animals and have indigenous technologies and knowledge which have been practiced for centuries and used to maintain the desirable characteristic of Ankole breed as is the case of other tribes in Uganda, Rwanda and Burundi (Nakimbugwe and Muchunguzi, 2003; Wurzinger *et al.*, 2005). However, prior to this study, extensive and detailed documentation on production systems, phenotypic and genetic characteristics, including that of the indigenous knowledge for breeding Ankole cattle have been lacking (ILRI, 2004).

Therefore in late 2003, the International Livestock Research Institute (ILRI), based in Nairobi, Kenya and BOKU - University of Natural Resources and Applied Life Sciences, in Austria, initiated a project to identify indigenous selection criteria for breeding and genetic diversity in African longhorn Ankole cattle. The project objectives were: (i) To describe Ankole cattle production systems and lifestyle of Ankole cattle keepers, (ii) To study and document indigenous knowledge in selecting animals for breeding used by Ankole cattle keepers, (iii) To describe the phenotypic characteristics (morphometric measurements) and (iv) To identify genetic diversity of longhorn Ankole cattle in countries of the Great lake Region namely, Uganda, Burundi, Rwanda and Tanzania (ILRI, 2004).

Documentation of indigenous knowledge of Ankole cattle keepers in animal breeding practices will not only assist livestock improvement programs and policy makers in integrating Ankole farmers' indigenous knowledge, but also will improve conservation of Ankole breed genetic diversity in aspiration of Ankole farmers. In addition, it will develop animal breeding models to increase Ankole breed production.

On the other hand, future increase in animal production will improve food security and increase household income; therefore, sustain the livelihoods of poor Ankole cattle keepers in the four countries where these unique cattle are found: Uganda, Burundi, Rwanda and Tanzania.

### **1.3 Objectives**

#### **1.3.1 Main objective**

This study was part of the broader Ankole project initiated by ILRI and BOKU in 2003. The main objective of this study was to assess and document the indigenous knowledge in animal husbandry and selection criteria for breeding Longhorn Ankole cattle.

#### **1.3.2 Specific objectives**

- i. To describe the lifestyle of Ankole keepers and their animal husbandry practices
- ii. To describe both, production and reproductive performance of Ankole cattle
- iii. To describe the indigenous selection criteria for breeding Ankole cattle.

### **1.3.3 Research questions**

- i. How pastoralists have maintained Ankole cattle breed for centuries in countries of the Great Lakes Region and why they prefer them to other cattle genotypes and the preference trends.
- ii. Which are the specific traits of cattle that are preferred and used by indigenous Ankole cattle keepers as their selection criteria for breeding.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Indigenous knowledge

##### 2.1.1 Definition

Indigenous knowledge refers to the knowledge, innovations and practices of indigenous and local communities around the world that developed from experience gained over the centuries and adapted to the local culture. Indigenous knowledge has been orally transmitted from generation to generation taking the form of stories, songs, folklore, proverbs, cultural values, beliefs, rituals, community laws, local language, and agricultural practices, including the development of plant species and animal breeds. Indigenous knowledge tends to be collectively owned and is mainly of a practical nature, particularly in such fields as agriculture, fisheries, health, horticulture, and forestry". Other closely related concepts of indigenous knowledge are local knowledge, indigenous technical knowledge and traditional knowledge.

Different definitions of indigenous knowledge do exist. This is because indigenous knowledge is not a uniform concept among all indigenous peoples, it is diverse and exists in varying layers, held by individuals, clans, bands or communities and cannot easily be separated from the user as it is part of their existence and normal usage (Warren, 1987). Additionally, the term indigenous knowledge is used broadly, with a variety of implicit and explicit definitions, depending on the forum within which it is being discussed. According to Warren (1987), indigenous knowledge is the systematic and unique body of knowledge to a given society acquired by local people through the accumulation of

experiences, informal experiments and intimate understanding of the environment in a given culture.

Indigenous knowledge is the actual knowledge of a given population that reflects the experiences based on traditions and includes more recent experiences with modern technologies. Warren (1987) describes indigenous knowledge as a complete knowledge system with its own concepts of epistemology, philosophy, and scientific and logical validity.

Indigenous knowledge in contrast to formal knowledge is stored in people's mind and handed over orally from generation to generation and is consequently not often documented (UNESCO, 2000). Unlike written documents and texts; accessibility or transmissions depends on the nature or type of knowledge (IRRI, 1994). Majority of community members' have public type of knowledge. Knowledge on environment and animal husbandry are regarded as public knowledge and can be accessed by asking elders (Kauzeni, 2003). A few people who might have had special training hold specialized knowledge; e.g., only a few villagers will become healers, midwives, or blacksmiths. Likewise, accurate indigenous knowledge that relates to cattle is likely to be the preserve of those who own cattle and have done so for centuries. The type of knowledge people have within society is function of role and characteristics of a given community (IRRI, 1994).

### 2.1.2 Methods to document indigenous knowledge

Village members, especially elders who have spent most of their lives in areas of interest, are the best sources of indigenous information or knowledge (Kauzeni, 2003). It is important to find out who knows what in order to tap the right sources because, indigenous knowledge is changing and unevenly distributed in villages (Kauzeni, 2003. IRRI,1994). For example, in most of pastoralist societies, elders know much on individual animal records, boys who graze know much about pastures whereas women know much on processing milk (Adekunle *et al.*, 2002).

There have been efforts toward understanding and documenting the knowledge of pastoral people and determine the value of non marketable traits (traits of preference) of their animals in Africa, Asia and elsewhere (Adekunle *et al.*, 2002; Koehler-Rollefson *et al.*, 2003; Kouadio *et al.*, 2003). As the step toward valuing the indigenous knowledge of local herders, ILRI and BOKU initiated Ankole project which, besides other objectives, aim at understanding and documenting indigenous knowledge in selection criteria for Ankole cattle breeding (ILRI, 2004).

Understanding, interpreting the meaning of local people provides the basis for local-level decision-making concerning many fundamental aspects of day to day life: for example hunting, fishing, agriculture and husbandry; food production, water management and adaptation to environmental or social changes (UNESCO, 2000). Currently there are studies on animal traits preference reported to be done in Kenya (Maasai) by a number of researchers including Scarpa *et al.* (2003) and Tano *et al.* (2003) whereas various studies have been conducted in Nigeria, Northern Tanzania; Bolivia and Nepal (Adekunle *et al.*,

2002; Koehler-Rollefson *et al.*, 2003; Kouadio *et al.*, 2003). Therefore documentation of some of pastoralist indigenous knowledge exists. This knowledge on livestock breeding and breed acts as a source of information about existing breeds that have escaped attention of scientists (DAGRIS, 2006).

Participatory rural appraisal approaches are useful for capturing information on indigenous knowledge (IRRI, 1994). Many researchers capture indigenous knowledge through face to face interviewing local people, organizing formal and informal discussion with local societies. However, the limitations of participatory approaches and the value of other methods such as sample survey, observation, in-depth interview are well recognized (Kauzeni, 2003).

Participatory methods and hypothetical choice experiment (adopted from economists) have been used more efficiently to describe indigenous knowledge in animal husbandry practices and determine traits of preference respectively, estimate traits value and investigate values of genetically determined traits that are not prominent in livestock population but desirable candidates for breeding or conservation programs (Scarpa *et al.*, 2003; Tano *et al.*, 2003; Kauzeni, 2003).

### **2.1.3 Indigenous knowledge in animal husbandry**

Most pastoralists use specific traditional practices to raise livestock to a given region and have been developed over a long period of time, handed down from one generation to the next, Ankole pastoralists are of no exception. The following are practical applications of indigenous practices that serve to illustrate how well pastoralists have learned to

manipulate the environment and to thereby derive utilitarian values there from. The major ones are:

#### **2.1.3.1 Animal feeding and grassland management practices**

Through acquaintance, many years of exposure to their natural grasslands, pastoralists are familiar with most plants and soils in their grasslands. They can also locate distribution of salinity soils (minerals sources) and describe the palatability of each plant for toxicity, and medicinal properties for the different animals they keep. They also know the seasonality of each plant with detailed indigenous knowledge for describing the nutritive value (not necessarily scientifically quantified) of different fodders used to livestock (Walker *et al.*, 1999).

In order to cope with the varying rainfall and forage distribution, pastoralists with their livestock must possess a high degree of mobility. Mobility enables pastoralists to exploit different environments and graze their animals throughout the year. Pastoralists move their herds throughout the year to optimize utilization of rangeland resources and to escape drought condition (URT, 2006). An elder Maasai pastoralist applying his local skills, was able to save his animals from this year's (2006) severe drought (URT, 2006). As a result of indigenous knowledge application his herds remain healthy, and continued to produce milk and meat to meet the demands of rural households.

Pastoralist herders have sufficient information and experience and special decision-making structures to organize their herd movements. They have knowledge and experience of supplementing their animals' diet with minerals, which not only protects

them against disease, but also enhances their appetite, growth, fertility, milk production e.t.c. They also have developed effective ways of ensuring knowledge acquired on the physical resources of the grasslands are adequately utilized (Mtengeti, 1994).

The majority of pastoralist societies, have division of labour, for example in Maasai society, warriors supervise grazing area and provide instruction on animal grazing behaviour (Mtengeti, 1994). Elders advice warriors on how to conduct ecological skirting, which includes identifying and classifying plants and accurately assessing the water-holding capacity of distant pastures. Elders also draw up movement itineraries on the basis of the warriors' reports (ibid). Hence, in pastoralist communities, animal husbandry practices and other important activities (breeding decision, herd composition) that influence herd diversity are done by men, while women are responsible for milk and milk product handling (Wurzinger *et al.*, 2005a).

#### **2.1.3.2 Animal health**

Animal health care involves medicinal and nutritional aspects. Pastoralists know several plants and soil/rock types for possessing livestock health care properties. Examples include, *Psidium guajava* leaf extracts for treating diarrhoe and dysentery, *Cordia africana* leaves for wound treatment and calcium rock extracts to take care of various mineral deficiencies (Bitegeko *et al.*, 2000).

Pastoralists have traditional practices to control livestock diseases and have been using traditional medicine to treat their sick animals since time immemorial. Traditional medicines are extracted from plants (leaves, barks, root and wood) and mineral soils.

Bitegeko *et al.* (2000) reported that traditional medicine still plays an important role in the nomadic life because some of these traditional products are highly efficacious. According to Adekunle *et al.* (2002), pastoralists are still using traditional livestock medicine because of inadequate veterinary officers, scarce, erratic supply and high cost of veterinary drugs, poor communication infrastructures facilities and government policies which do not favour indigenous systems.

According to Walter and Dietrich (1992), pastoralists practice the following to keep their animals healthy or free from ticks: i) avoid places with high tick infestation ii) feed animals on plants containing a high level of salt, thus the ticks fall off iii) before leaving the enclosure in the morning, women and children collect ticks from the animals and throw them into a fire burning near the entrance to the enclosure and iv) burning the infested pasture is widely used in case of extremely high ticks infestation.

Herd separation is used to reduce the risk of infecting all animals belonging to one household and contact between healthy and ill animals. Additionally, choosing animals for breeding is based on the health of the animal. This implies that, local people have wide-ranging knowledge on livestock disease control and also are able to detect diseases affecting their animals. Understanding some of poor and good practices under the influence of indigenous knowledge could be the possible integration point between developed and indigenous knowledge in improving indigenous knowledge and hence, the livelihood of marginalized farmers.

### 2.1.3.3 Breeding practices

Indigenous knowledge about animal breeding and breeds refers to the knowledge that traditionally breeders apply to manipulate the genetic composition of their herds. It includes knowledge and experience about genetic attributes of their livestock and inheritance, as well as conscious strategies and social mechanism that influence the genetic pool (Koehler-Rollefson *et al.*, 2003).

Different societies have developed most of 7000 genetically adapted animal breeds registered in FAO database (Koehler-Rollefson *et al.*, 2003). Indigenous knowledge on breeding decision influenced genetic performance of indigenous cattle breeds in developing countries through: cultural concepts about how to use animals, local preferences for certain characteristics, such as colour, body size, productivity, adaptability and behaviour patterns , selection practices for certain qualities (castration, culling) and pedigree-keeping.

Breeding decisions include objectives and goals. Breeding objectives are multifaceted traits that are necessary for a breed to fulfill its role in the overall production system: most of cattle keepers select bulls from i) a well known lineage ii) performance of the parent animals iii) ability of the lineage to resist disease iv) a lineage with offspring that remains healthy from birth to maturity, whereas breeding goals include the personal selection criteria, which do not necessarily relate to the functionality of the animal (Andom *et al.*, 2002).

Selection criteria in animal breeding are referred to as observations utilized in the estimation of an animal's genetic value since the true genetic value based on a certain trait is unknown and sometimes not measurable (Falconer, 1996). Different societies have different selection criteria for breeding cattle that favors different cattle breeds over others. Selection criteria as related to local people are natural means by which an animal is compared and judged to be retained into the herd according to its ancestry and physical appearance; factors included in selection criteria are; owner preference, animal manageability and breed genotype (Koehler-Rollefson *et al.*, 2003).

Different pastoralists have their traits of preference when selecting animals for breeding. According to herders in Gambia, important traits for a good breeding bull are; traits related to growth, high milk yield of dam, health, reproductive efficiency, physical appearance and behaviour of the bull (Jaitner *et al.*, 2003).

#### **2.1.4 Importance of indigenous knowledge**

Indigenous knowledge has made important contributions to the pastoralist society in areas like food, medicine sciences, economy and politics. Additionally, indigenous knowledge and practices have played an important role as foundation for the survival of indigenous people worldwide.

First and foremost, indigenous knowledge is most important to the indigenous people themselves as it provides a strong base from which culture adapts to the changing circumstances and is passed on to different people. It also represents a way of life that has evolved with the local environment, so it is specifically adapted to the requirements of

local people and conditions (Kauzeni, 2003). For pastoralist societies, there is a constant movement of animals and herders as the traditional lifestyle, searching for water and pasture or avoid disease infected areas (Walter and Dietrich, 1992).

For development interventions to be successful, indigenous knowledge is vital. Utilizing indigenous knowledge in research projects and management plans gives such activities legitimacy and credibility in the eyes of both local people and outside scientists, increasing cultural pride and thus motivation to solve local problems with local initiatives and resources c.g Ankole project in countries of Great Lakes region. Majority acknowledged the need for an understanding of indigenous knowledge and for the incorporation of traditional local knowledge and experience into development efforts.

Indigenous knowledge is a rich resource that it is worth preserving for the benefit of mankind in general. A 'conservation ethic' often exists in indigenous societies. Natural resources are considered sacred, humans are dependent on nature for survival, and all species are interconnected. Ankole cattle breed is considered sacred and are valued by Ankole keepers, thus, understanding indigenous knowledge that maintained this unique cattle breed for centuries would be important in informing its conservation.

Indigenous knowledge can be improved through infusion with outside knowledge and vice versa. As revealed by Kauzeni (2003) the challenge is to come up with the right dosage of local knowledge to be mixed with formal knowledge to get proper scheme for indigenous cattle improvement. Indigenous knowledge is specific and researchers should not make the mistake of believing that whatever indigenous people know in animal husbandry is right

or sustainable to other herd societies. There are things to consider, such as; knowledge replication to other environment, advance in formal technology, environment changes, human population pressure and society traditional lifestyle.

## 2.2 Pastoralism

### 2.2.1 Lifestyle of pastoralists

A pastoralist is a member of a society that depends on animal husbandry in which animal herd is regarded as an important element for the livelihood. Most of pastoralist herds are large and sometimes composed of multiple species. For example, the herd may include cattle, goats and sheep or camels, sheep and goats; camels and donkeys etc (WRI, 2005). Sometimes a large herd is perceived to be an insurance mechanism that allows an individual pastoralist to survive through periods of stress, including drought and disease epidemics. It also allow faster recovery after drought, and more supply of milk and meat per herd. Including small stock species like goats and sheep in herd enable pastoralists to harvest a greater proportion of available forage in the rangeland and produce livestock product throughout. The systems of loaning, gifts of livestock and use of livestock for dowry tend to complement livestock ownership and help to rebuild the herd after drought in different pastoralist societies. Pastoralists keep cattle for: beef production, hides and milk production (Adekunle *et al.*, 2002). Since milk is usually a staple food of pastoralist, female often dominates Ankole cattle herd as it allows more household members to be supported by the same herd. Movement of all or part of the society with animals is considered a normal and natural way of life. Examples of societies whose livestock are main source of livelihood are Maasai, Borana, Turkana, Afar and Wahima just to mention a few.

In Nigeria, movement of the herdsmen, pastoralists families and the herds from place to place, has been reported to be traditional lifestyle of indigenous pastoralists as this ensures them with fodder, water availability and animal health (Adekunle *et al.*, 2002). Maasai pastoralists of Tanzania are reported to use pastoralism mode of animal production with the following reasons: i) avoiding livestock diseases in areas where they have been grazing their animal for a long time, ii) searching for new pasture and available water for their livestock and iii) giving time for the regeneration of pastures (Kauzeni, 2003). All reasons given have some scientific backing and concepts. Government and other development efforts therefore need to understand this fact and other applied local knowledge prior to interventions.

### **2.2.2 The contribution of livestock to pastoralists livelihoods**

Livelihoods in this context mean the whole complex of factors that allow pastoralists societies to sustain themselves materially, emotionally, spiritually, and socially. Central to this are food and income in the form of cash derived by selling animals, or in the form of natural products directly consumed for subsistence, such as milk, meat, animal blood or hides and skins.

Livestock are an important element of the livelihood strategies and their roles extends significantly beyond their economic value to the pastoralist societies. In a comparative study of poor livestock keepers in Bolivia, India, and Kenya, households in all three countries ranked livestock as their best form of investments (living banks). Owning livestock can also bring better nutrition to some of the most vulnerable groups, including women and children among pastoralist communities (WRI, 2005).

Furthermore, livestock play a prominent role in social and cultural relationships. The social contribution of livestock is important because ownership of livestock confers status in many cultures. Loans and gifts of livestock contribute to family and community ties and often play a central role in cultural traditions such as weddings and funerals (WRI, 2005). Also, animals are the most important asset owned and a crucial source of financial capital for pastoralists. For many, livestock ownership is the only form of life insurance. Livestock provide a critical reserve against emergencies and decrease vulnerability to financial shocks from ill health and other risks. When the poor pastoralists have access to markets, livestock can serve as a source of collateral, giving households access to other forms of capital and opening pathways for further income diversification (WRI, 2005; Mtengeti, 1994).

### **2.2.3 Factors leading to a change in the lifestyle of pastoralists**

Despite the fact that over 70% of animal products are from livestock kept by pastoralists, most authorities regard pastoralism as the primitive mode of livestock management that will soon die. According to Mtengeti (1994) and Wurzinger *et al.* (2005a), many ethnic groups who were previously completely pastoralists are now either sedentary or on transitory stages between pastoralism and permanent settlement (agriculturalists). There are several factors that influence pastoralist lifestyle. These include; new borders, reduction of pasture tenures in favour of arable farmland, industrial projects, exploitation of natural resources and nature reserves projects. These are among the development factors which are forcing pastoralists to abandon their nomadic lifestyle. Other factors are those related with human population pressure and environment changes.

The increasing pressure on land due to the increase of agricultural population coupled with government policies, which strongly advocate for sedentarisation and conservation of wildlife in traditional pastoral areas, are further threats to nomadic pastoral production systems (Mtengeti, 1994). Pastoralist societies in Uganda are increasingly facing market-driven demands to 'settle down' on a piece of land – pressures that are not only disrupting their centuries-old lifestyle but also taking a value of the indigenous, long-horned Ankole breed. The general lack of interest of the youths towards this form of life style aggravates the situation (Panos, 2006).

Nevertheless, almost all indigenous cattle breeds that are kept in Sub Saharan Africa are still under traditional sector (URT, 2004) rose for centuries under traditional animal production system, based on indigenous knowledge of their owner. Recently, Wurzinger *et al.* (2005b) reported that, Ankole pastoralists in Uganda are still practicing mobile mode of animal production.

### **2.3 Reasons for late acknowledgement of indigenous knowledge**

The existence and importance of indigenous knowledge is worldwide acknowledged. According to Kauzeni (2003), late consciousness of the importance of indigenous knowledge, particularly in herd societies was mainly due to the following factors:

- i. Inadequate documents regarding herders and their knowledge, and superiority complex syndrome of researchers where they look down upon pastoralists as individuals with little or no education at all and hence cannot understand scientific complexities of the livestock they depended on for so long.

- ii. Some people have notion that exotic cattle breeds from European countries are superior or are of more value than the locally developed or evolved breeds regardless of their incompatibility with the existing social, economic and environmental conditions.
- iii. Policy makers, development planners or researchers mislead themselves by thinking that they know more than the herdsman. In other hand, training that they have received has had some great influence in what they believe and value, and has impact in the way they think and do things.

#### **2.4. Production and reproductive performance of Indigenous cattle breed in Africa**

The indigenous cattle breeds in Africa produce and reproduce under very harsh environmental conditions and are therefore considered as an important asset since they have developed over time valuable adaptive traits (Brumby and Trail, 1986). Most of the indigenous cattle in Africa are kept under extremely simple management conditions with no or little supplementary feed and health care, therefore their survival depends on their ability to cope with environmental stresses ( Brumby and Trail, 1986). Accordingly, locally adapted indigenous cattle breeds in developing countries have absolute low production figures (Table 1), nevertheless, productivity turns out to be high if the production environment, breeding strategies and level of input are taken into consideration (Bayer *et al.*, 2003; Scarpa *et al.*, 2003).

**Table 1: Reproductive and lactation performance of indigenous cattle in Africa**

Trait	Average	Breed	Location	Source
Age at first calving (years)	4	Kenana cattle	Sudan	Saeed <i>et al.</i> , (1987)
	3.9	Boran cattle	Tanzania	Trail <i>et al.</i> (1981)
	4.5	SEAZ	Kenya	Mwacharo <i>et al.</i> , (2002)
	2.9	EAZ	Ethiopia	Mukasa-Mugerwa (1989)
	3.6	EAZ	Uganda	Mukasa-Mugerwa (1989)
	4	Fulani	Senegal	Joshi <i>et al.</i> , (1957)
	3.5-4	Ankole	Rwanda	Joshi <i>et al.</i> , (1957)
Calving interval (years)	1.3	SEAZ	Kenya	Mwacharo <i>et al.</i> , (2002)
	1.3	Kenana cattle	Sudan	Saeed <i>et al.</i> (1987)
	1.1	Ankole	Rwanda	Mukasa-Mugerwa (1989)
	1.2	Africander	Zambia	Mukasa-Mugerwa (1989)
	1.3	Boran cattle	Tanzania	Trail <i>et al.</i> (1985)
	1.5	Malawi Zebu	Malawi	Mukasa-Mugerwa (1989)
Lactation at peak (litres)	3.1	SEAZ	Kenya	Mwacharo and Rege (2002)
Age at culling breeding female (years)	11.3	SEAZ	Kenya	Mwacharo and Rege (2002)
Age at culling breeding males (years)	7.2	SEAZ	Kenya	Mwacharo and Rege (2002)

## CHAPTER THREE

### MATERIALS AND METHODS

#### 3.1 Description of the study area

This study was carried out in Kigoma and Kagera regions of Western Tanzania. The choice of the study area was based on the availability and high concentration of Ankole cattle and their related breeds (Ankole crosses and TSHZ). Kagera and Kigoma regions lie between lakes Victoria and Tanganyika and between longitude 29<sup>0</sup>-32<sup>0</sup> E and latitude 1<sup>0</sup>- 4°S (Fig. 1). The climate of both Kagera and Kigoma are characteristically tropical with a distinct long wet rainy season in Kagera. (URT, 2004; URT, 2005). Total annual rainfall for both regions ranges from 500mm to 2000mm (URT, 1998).

##### 3.1.1 Kagera region

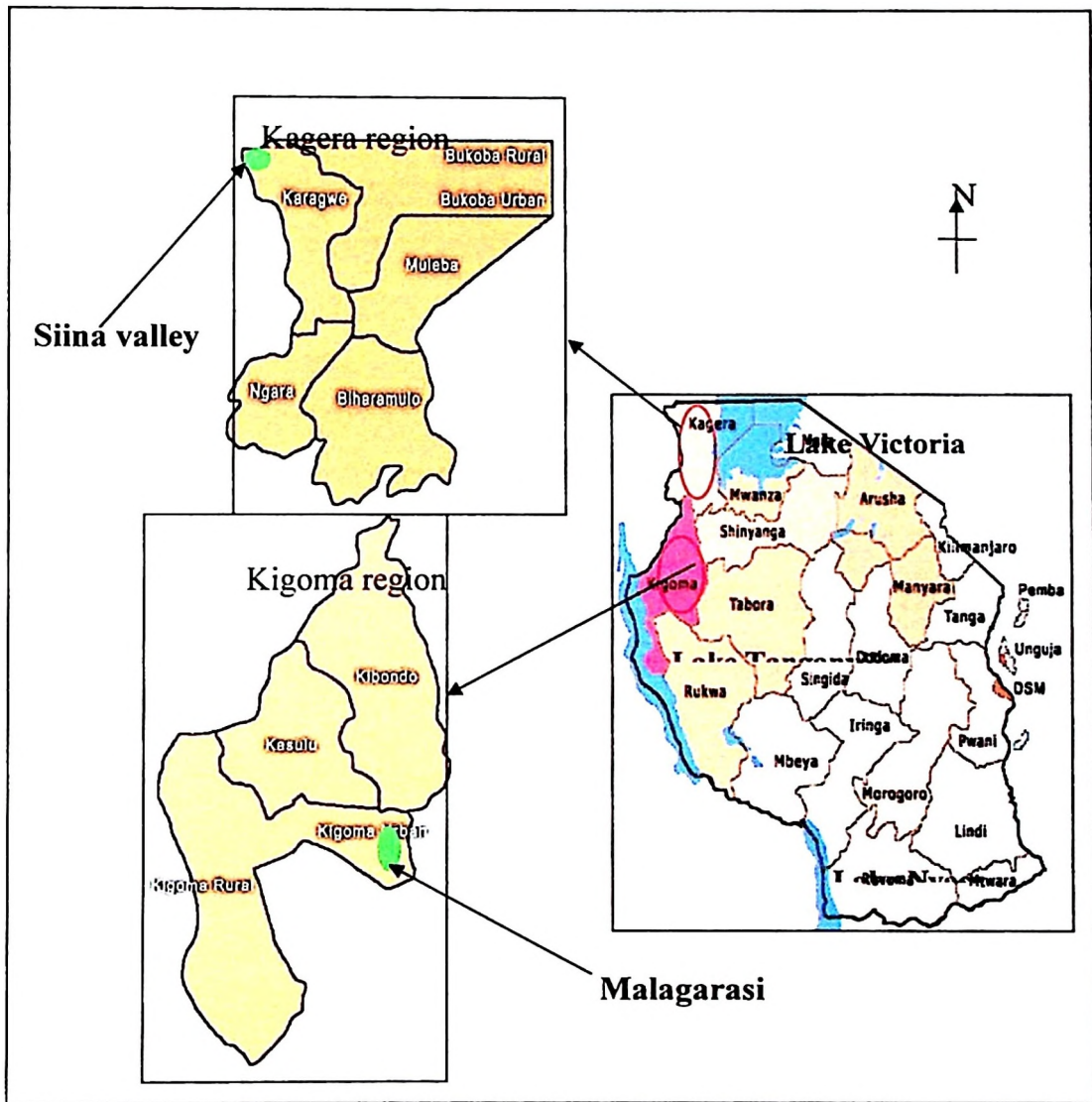
Kágera Region covers 40,838 km<sup>2</sup> and comprises of six administrative units. These are districts of Bukoba Urban, Bukoba Rural, Muleba, Biharamulo, Ngora and Karagwe. Bantu groups are indigenous in this area; these include Wahaya, Wanyambo, Wasubi, Wahangaza. Other Bantu groups such as Wasukuma, Wazinza and Warongo are minorities in Biharamulo District (URT, 2004).

Karagwe District administratively comprises of 6 divisions. Isingiro division (Siina Valley) where the study was specifically conducted has dominant tribes keeping Ankole cattle in traditional systems. These are: Wanyambo (also practice cropping) and Wahima who are predominantly pastoralists or livestock keepers (URT, 2004).

### 3.1.2 Kigoma region

Kigoma Region covers a total area of 45,066 km<sup>2</sup> of which land area is 37,037 km<sup>2</sup>. The administrative units in the region are districts of Kasulu , Kibondo and Kigoma with Kigoma/Ujiji Township. Kigoma District comprises a total of 18 divisions, 81 wards and 220 villages (URT, 2004).

Kigoma District has short dry spell of 2-3 weeks in January or February followed by a prolonged dry season before October. The economy of this district largely depends on indigenous livestock rearing. Ankole cattle breed and its related genotype (mainly ankole Zebu crosses) are indigenous cattle breeds in Kigoma, and are largely kept at Nguruka (Malagarasi valley) where the study was conducted. Other livestock kept include: goats, sheep, chicken and dogs. Dairy cattle and goat keeping though introduced some years back, has not well developed (URT, 2005). The tribes who keep these cattle are Waha and Tutsi (URT, 2004).



**Figure 1. Map of Tanzania, showing the study areas.**

Source: (URT, 2006)

Topographical features of Karagwe and Kigoma districts are characteristically lowland with similar conditions and characteristics such as fertile soil, availability of green pastures and predicted rainfall with scattered water points such as, natural ponds, springs, rivers and lakes.

### **3.3 Research design**

The study employed cross-sectional research technique. Cross-sectional research was used because it involves data collection of all variables within a narrow time span, hence, more economical in both time and costs than other designs. (Baltes, *et al.*, 1988; Creswell, 1998) The study was divided into; - baseline survey, village level workshops and hypothetical choice experiment (choice cards).

For choice cards, a design to estimate main effects and two-way interactions between all attributes was used. 64 profiles (full factorial design) with 6 attributes with 2 levels each using D-efficiency criterion were designed (Kuhfeld, 2005). From these 64 profiles, 24 choice-sets consisting of 2 profiles each were chosen (Details in section 3.5.1). These 24 choice sets were grouped into 4 blocks with 6 choice sets each (Appendix 2). This procedure was performed with SAS Macros (SAS, 2002).

### **3.4 Sampling Procedure and sample size**

The sampling unit was the household head and systematic sampling technique was used to get the sample size. A total of 171 respondents were interviewed for this study. The sample constituted of 60 farmers for baseline survey and 111 farmers for hypothetical choice cards experiment. Interviews were carried out in Kagera and Kigoma Regions. In each region 30 respondents were interviewed. In each region, local Livestock officers identified and inform farmers in advance before conducting the study to ensure availability of respondents.

Data were collected from September 2005 to February 2006. The following assumptions were made for this design;

- i. Ankole keepers are homogeneous in cultural, economic and social characteristics in each region; hence the sampled livestock keepers represent all other livestock keepers.
- ii. Basing on the fact that most pastoralists do not keep records, the accuracy of some data collected depends on individual's ability to recall.

### **3.5 Data collection**

Data collection refers to both the selection of sampled units and the way data is collected from them. There are several methods of data collection, however, in this study three types of data collection methods were used: questionnaire (baseline survey), focus group discussion (PRA-workshops) and hypothetical choice experiment (choice cards). Three methods were used to capture information because no single data collection tool can obtain the range of information needed in a study of this kind.

#### **3.5.1 Primary data**

##### **(a) Baseline survey**

For the baseline survey a multi-sections questionnaire (appendix i) was developed and it consisted of both open and closed questions. The sections covered by questionnaire were; general characteristics of households, their lifestyle and animal husbandry practices. Some questions on animal marketing, use of animal products, land ownership, animal health services, traditional roles of animal and future trend in Ankole keeping were included. Thirty (30) farmers were randomly sampled and interviewed from each of the two study

areas, making a total of sixty (60) households interviewed. To capture information on reasons why Ankole cattle were kept and selection criteria, the farmers were asked to first list 5 important traits and then rank the 3 most important ones from 1 (most important) to 3 (less important). Finally, all information was entered in a database and analysed.

#### **(b) Workshops**

Workshop in this context refers to focus group discussion as related to Participatory Rural Appraisal (PRA). The study designed discussion topics to obtain perceptions in indigenous selection criteria for Ankole cattle breeding in a permissive, non-threatening environment. Two workshops were conducted in each of the study areas covering the following topics; seasonal calendar of the particular area, sedentarisation/historical mapping, animal traits heritability, breeding and animals management practices (Appendix ii). The participants to each of the workshop were Ankole cattle keepers, local livestock officer, village executive officer and researcher. Different groups of at least 12 farmers were selected by local livestock officer for each workshop. The workshops were used to brief officials and farmers on study objective and to explore their knowledge about Ankole cattle. Various participatory tools were administered in Focus Group Discussions as follows.

#### **(i) Priority lists of farmer expectations**

Farmers were requested to prioritise their expectations. These were compared and collated as shown in Appendix iv. The priority lists were then used for discussion and to elaborate the topic of interest as related to workshop guideline (Appendix iii).

**(ii) Mapping**

Workshop participants (Appendix iv) were asked to draw a map of their community on the paper, making the key features of the village, and each farmer was asked to locate his homestead and distance to watering point and movement when searching for pastures.

**(iii) Seasonal calendar**

The lives of pastoralists depends on availability of pastures and agriculture as related to rhythmic changes of the seasons throughout a year. Accordingly, farmers were asked to label the matrix on the flip chart, with the months on top and activities or animal productions on the vertical axis. The discussion focused on when people do agriculture related activities and animal performances across the year.

**(iv) Sedentarisation**

The farmers were asked to remember the historical important events of Tanzania dating back to 1900 up to date. Based on that recall, each participant was to tell when and why he moved to the area, what type of cattle he has and how he acquires land.

**( v) Breeding practices**

Head of the household largely does the breeding practices among pastoralist societies. Bulls and cows are differently treated when it comes to breeding. Thus, for a breeding bull, the discussion focused on; origin of the bull, time and number of bull(s) stay in the herd, important traits for breeding bull and the consequences if the bull doesn't have those traits. For the cow, the following were discussed: origin of the cow, time to be in the herd and culling criteria.

**(vi) Heritability of traits**

Once farmers were introduced on what is heritability, individual poster/card with trait of interest was shown to them for discussion. After thorough discussion basing on their local

experience, farmers were asked to rate the trait and accordingly, the particular trait was given its value (percentage heritable).

**(vii) Management and behaviour of animals**

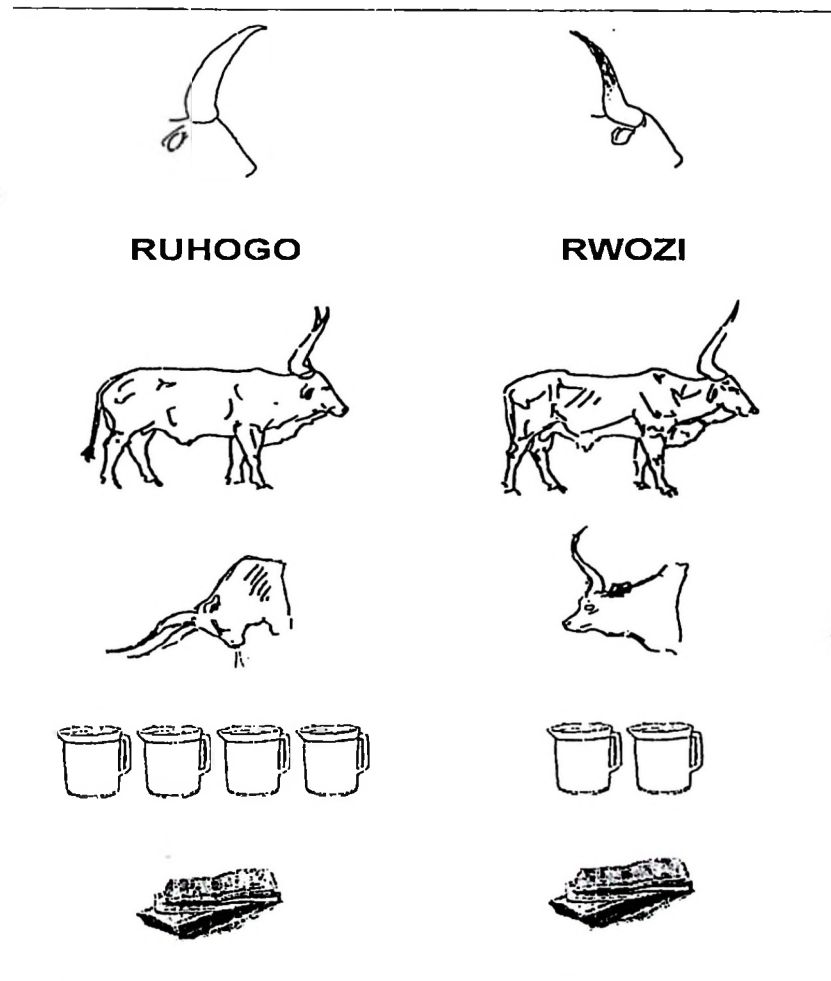
This topic involves; animal behaviour within moving herd, at milking, at calving and during watering. The farmer also discussed on their duties, social interaction with animals and animal- animal interaction.

**(c) Hypothetical choice experiment (choice cards)**

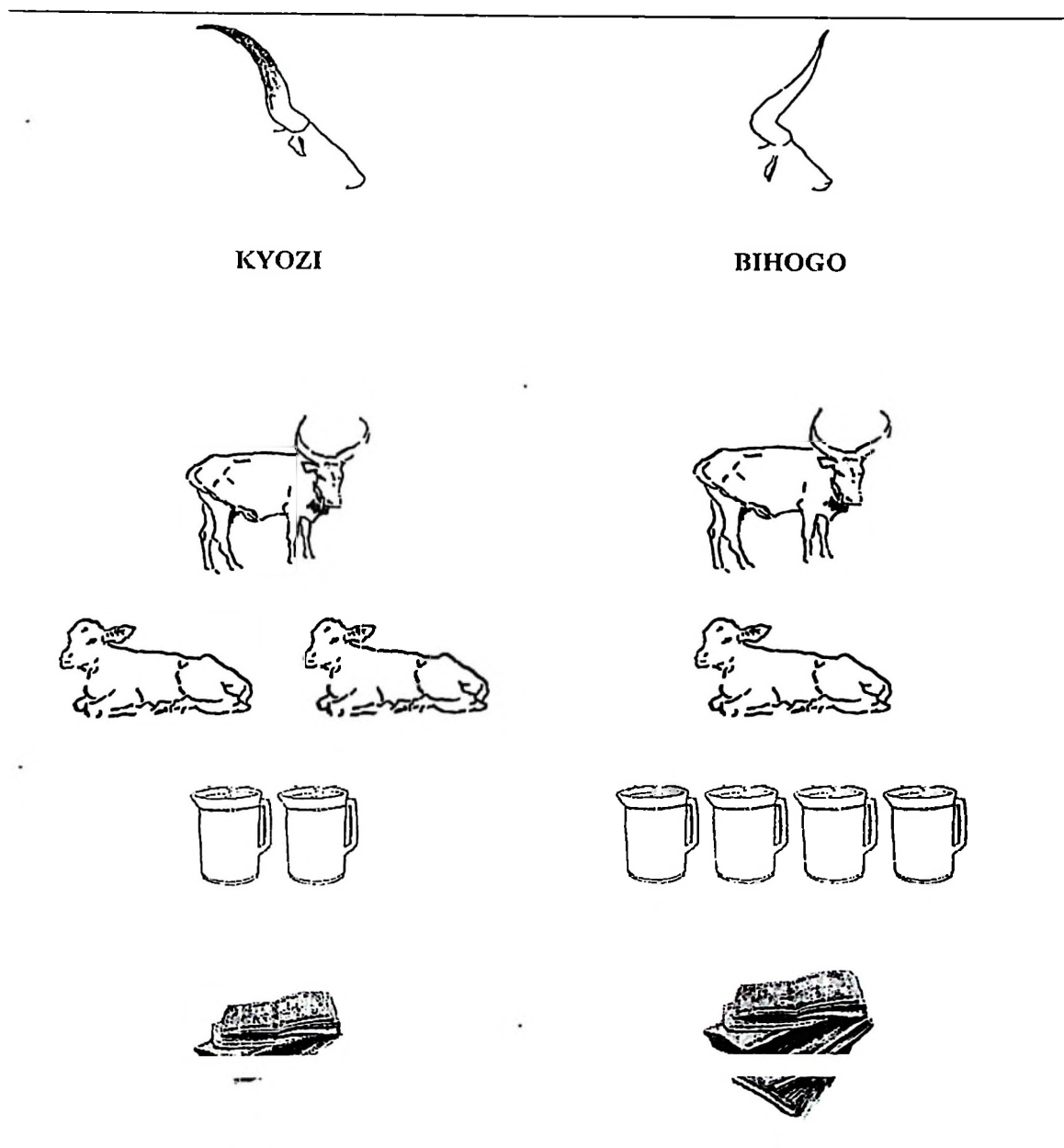
For this study, cards with illustrative five phenotypic characteristics of bulls and cows were used to display each cattle profile to farmers. Each farmer was to tell his preference (good-bad); also he has an option of not choosing any of the display. Each farmer ranked six cards for bull and six for cows. For bulls, traits displayed were, horn ( forward, white and backwards, dark coloured), coat colour (dark brown/ruhogo and black/rwozi), muscularity (healthy and skinny), temperament (aggressive and calm) and the record of its dam milk production (4 litres and 2 litres) (Figure. 2a). Whereas cows traits were: horn (as bull), coat colour (dark brown/bihogo and black/kyozi), body size (small and large), fertility (1 calf/year and 1 calf in two years) and milk production (4 litres and 2 litres) (Figure. 2b). Price was added as a sixth trait. Current market prices for animals at high and low extremes were used for each region.

Horn (colour and shape) and coat colour were chosen to represent the aesthetic of the animals, temperament was used for bulls as an important feature for herding and handling ease, milk yield and fertility represent production and reproduction, respectively. No adaptive traits such as disease resistance were included in the profile, as they were not

mentioned as important for selection decisions in the interview carried out during the baseline survey.



**Figure 2a Hypothetical choice card for bull profile**



**Figure 2b Hypothetical choice card for cow profile**

For data accuracy, different animal profiles were displayed to a single farmer with animals coat colours translated into respective local languages (Appendix iii). The use of local language made it possible to get information from wide range of age categories

within the society of Ankole cattle keepers. To ensure that there was information connection between baseline survey and hypothetical choice experiment, 60 households included in baseline survey were also involved in hypothetical choice experiment. Thirty (30) new farmers were involved in hypothetical choice experiment from each district, making a total expectation of 120 households to be involved. Nevertheless, the final sample included 111 of the 120 expected households because some of the farmers were unreachable due to rainfall particularly in Kigoma and time factor to the researcher in both districts.

### **3.5.2 Secondary data**

Data from secondary sources were obtained by consulting relevant officials documents both published and unpublished obtained from the libraries of SUA and ILRI. Other sources include electronic copies at Internet and official reports from both Kagera and Kigoma regional Livestock officers.

## **3.6 Data analysis**

### **3.6.1 Baseline survey data**

The frequency counts and means were computed for each data set using SPSS. Size of pure Ankole herds was obtained by adding genotypes Ankole bulls, cows, heifers and calves. In order to calculate the size of mixed herds all classes of pure breed Ankole, other pure breed and crossbred animals were added. Information on reproductive parameters in cows and bulls were obtained from direct interviews and not by analysing data from herd recording. The data sets for important trait of keeping Ankole and as a selection criterion were computed using SAS (2002).

### **3.6.2 Workshops**

All data gathered through Participatory Rapid Appraisal (Focus Group Discussion) were subjected to systematic content analysis. Information on seasonal calendar, sedentarisation/historical mapping, animal traits heritability, breeding and animals management practices were obtained to reveal the orientation of indigenous selection criteria for breeding and other useful information.

### **3.6.3 Hypothetical choice experiment**

The data was analysed using logistic regression on a binary trait, “chosen” versus “not chosen”, excluding the small proportion of observations where none of the two options was chosen. Binomial (or binary) logistic regression is a form of regression which is used when the dependent is a dichotomy and the independents are of any type. Logistic regression can be used to rank the relative importance of independents; and to assess interaction effects.

## CHAPTER FOUR

### RESULTS AND DISCUSSION

#### 4.1 Overview

Pastoralists over centuries have learned how to keep cattle breeds and to survive in a sometimes-difficult environment. Traditionally, they know (i) why, how and what breed to keep among many available cattle breeds, (ii) why and when to move with animals and (iii) how to maintain performances and conserve genetic diversity of their herds (breeding objective and goals).

To find out what people know the right people to ask must be identified. Development professionals sometimes think that villagers know very little, when in fact the wrong people have been interviewed. For example, Maasai warriors do herding and hence know better where the best grazing sites are. If asking Maasai elders to show sites of good pastures, only partial information might be acquired.

Hence, in order to document indigenous knowledge of Ankole cattle keepers regarding Ankole cattle breed management, this study involved elders who own Ankole cattle and well experienced in Ankole cattle husbandry. This chapter covers the following: Ankole keeper's lifestyle, their animal husbandry practices and indigenous selection criteria for breeding Ankole cattle in Kagera and Kigoma regions in Western Tanzania.

## **4.2 Background characteristics of the population**

### **4.2.1 Sex and age of the household head**

All respondents were male. In most cases the household head (76%), followed by son of the household head (16%) and combination of son, household head and other household members related to household head (8 %approximately) were interviewed. This may not be unconnected with the fact that for pastoralist society cattle rearing is a male dominated occupation (Table 3). Culture does not permit women to claim ownership in the presence of a stranger even where women own a few cattle which are traditionally given as gift when married. Household head (man) among Ankole cattle keepers owns almost all cattle. Jaitner *et al.* (2003) reported the same findings from pastoralist societies in Gambia.

Age is an important variable when considering the use of indigenous knowledge in selecting animal for breeding. Most of the respondents in both regions had age above 20 years, whereas (69%) had age ranging between 30 and 69 years, therefore well experienced in animal husbandry practices and knowledgeable in indigenous principles of rearing and breeding Ankole cattle.

### **4.2.2 Lifestyle**

Unlike the past decades, at present pastoralists are naturally forced to settle or practice agro-pastoralism (Helen *et al.*, 2003). Currently, there is significant difference in lifestyle between Ankole cattle keepers found in Kagera and Kigoma regions. In Kagera 70% are settled and only 30% live semi-nomadic, whereas in Kigoma the majority (66.6%) are moving with their herds. However, the current lifestyle (agro-pastoralism) experienced in Kagera does not limit the movement of herd searching for pasture and water.

In both regions draught periods and land shortage as has been reported by Mtengeti for Maasai society (1994) are also given as reasons for Ankole cattle keepers movement. Ankole cattle keepers mentioned a number of difficulties frequently faced as a result of practicing pastoralism. These include: (i) Problems relating to food insecurity and shelter (ii) attack from wild animals and (iii) break up of family structures.

Despite the fact that Ankole cattle keepers are facing the mentioned difficulties, currently as revealed in this study, there is no general conclusion that Ankole cattle keepers in western Tanzania have abandoned their traditional lifestyle. To the contrary, Ankole cattle keepers in Uganda are reported to settle because of population and environment forces (Helen *et al.*, 2003).

### **4.3 Socio-economic factors**

#### **4.3.1 Education of household head**

The profile of respondents according to educational attainment in the two regions shows a high level (73%) of informal education among household heads. However, few (<20%) household members had attained primary education. This may not affect their indigenous knowledge or breeding objectives of cattle because the level of educational attainment is not high enough to change traditional practices and lifestyle. This implies that, most of the respondents have long-term experiences with Ankole cattle management and hence knowledge in selection criteria for breeding longhorn Ankole cattle in western Tanzania. High level of informal education plays great role in practicing lifestyle and animal husbandry in traditional ways.

#### **4.3.2 Household livelihood economy**

Regarding sources of livelihood, more than 75% of respondents in Kigoma Region mentioned livestock production is the major source of livelihood. Most (98%) of pastoralists in Kigoma Region rarely mentioned to practice cultivation or other economic activities compared to Kagera Region, whereas agro-pastoralism (70%) and other off-farm activities play an important role in the livelihoods of many Ankole cattle keepers' households. Pastoralist societies, as Ankole cattle keepers, have knowledge regarding seasonal dynamics and how to distribute different production activities to sustain their livelihood. The economic activities mentioned were crop cultivation and animal husbandry related activities (Fig. 2 and Fig. 3).

Pertaining to animal management and breeding, the participants stated that, knowing seasonal patterns helps in deciding the size and number of animals to produce. Clarifying further, participants stated, if they want large body sized animals (specifically male animals or breeding bulls), the selected female cows, normally already calved, are to be mated such that they calve during high pasture availability as shown in their season calendars (Fig. 2 and Fig. 3).

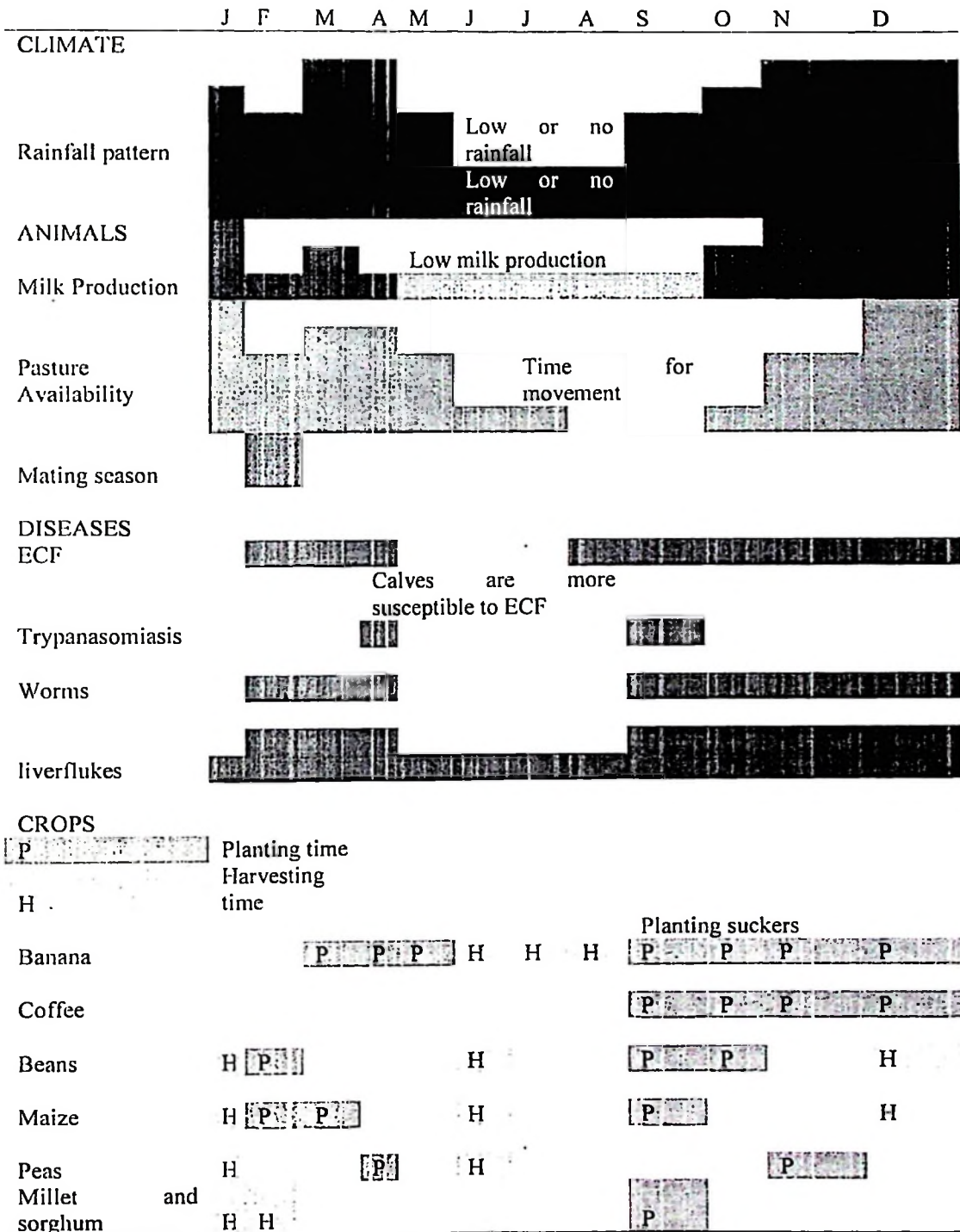
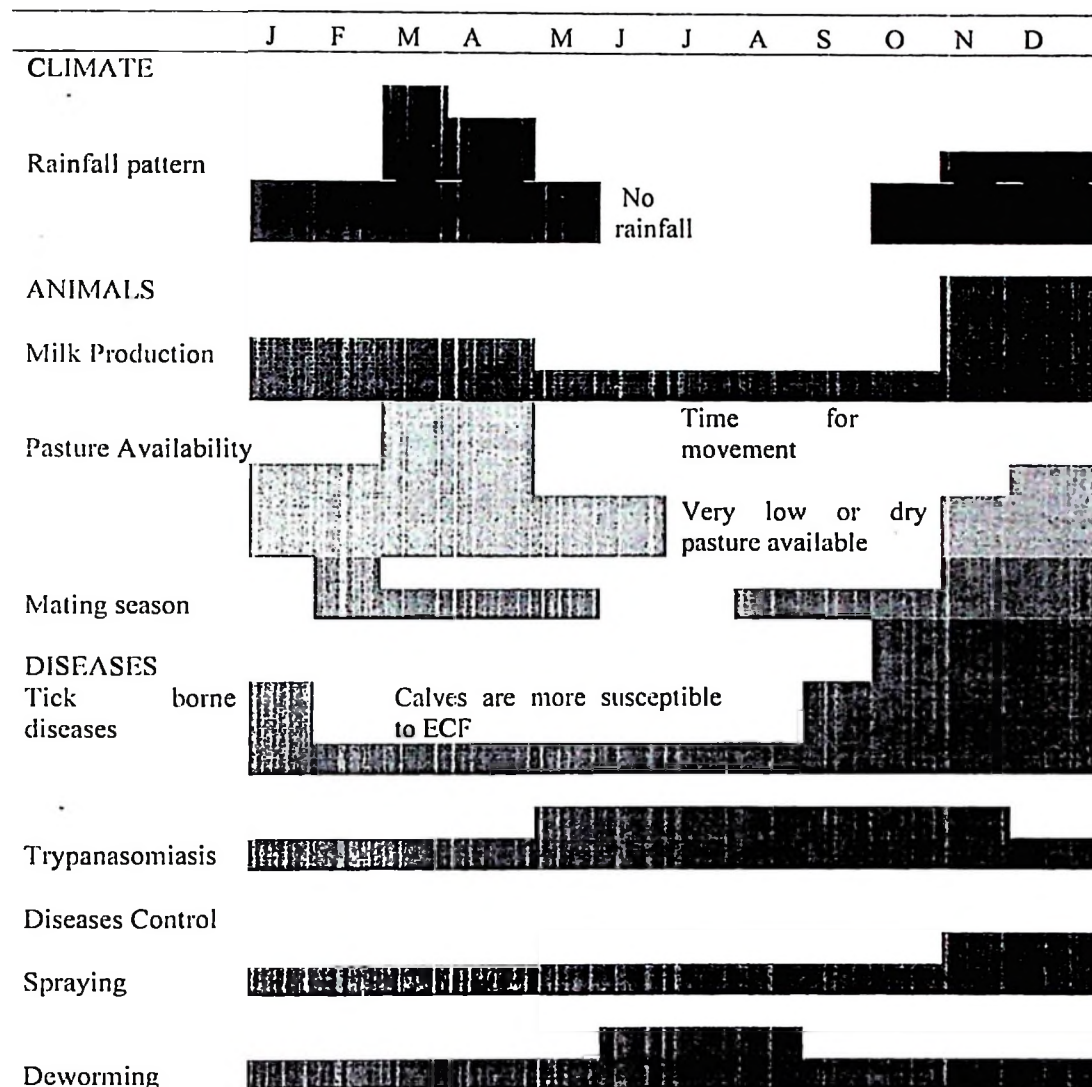


Figure 2: Seasonal calendar for Ankole cattle keepers in Kagera region (P=Planting, H= Harvesting)



**Figure 3: Seasonal calendar for Ankole cattle keepers in Kigoma region**

Traditionally, the diet of Ankole cattle keepers is based on milk and milk products from Ankole cattle. Ankole cattle keepers in Kagera and Kigoma regions mentioned over 90% of Ankole products are exclusively for home consumption. Fresh milk and milk products like ghee and sour milk are consumed in the household and lesser percent sold when there is extreme high supply. This implies that, Ankole cattle keepers still depend on milk as

staple food and hence breeding decision and target should always reflect on animals that will produce more milk to meet food demand for their households.

Some farmers in Kigoma Region mentioned the use of urine from cattle for washing *byansi* (milk gourds). Urine from cattle is used as a detergent in cleaning of milk pots, mixed with herbs as a mouthwash or for skin infections (Nakimbugwe and Muchunguzi, 2003). However, with the beginning of agricultural activities specifically in Kagera Region and to a lesser extent in Kigoma Region the diets are enriched with other products. Some farmers in both regions mentioned the use of hides and manure for home consumption, but also for selling.

#### **4.4 Herd management**

##### **4.4.1 Livestock kept and herd composition**

The study revealed that herds of Ankole cattle keepers in both Kigoma and Kagera regions were composed of pure Ankole, Ankole related breeds, zebu and other livestock species including; sheep, goat, and few poultry (Table 2). Ankole cattle keepers maintain herd in multi-species as other pastoralist societies in order to meet large households demand. Additionally, most pastoralist societies keep different livestock species to make full utilization of available pasture, increase animal production and distribute the risk that led to loose animals due to natural misfortune (Mtengeti, 1994).

Since pastoralist societies depend on animals for survival, large herd size is maintained as coping strategy for obtaining enough milk and available animals for sale to fulfil their basic needs. Petersen *et al.* (2004) also reported that, most traditional African cattle

owners keep cattle primarily to assure supply of milk and secondary to accumulate stock as a form of investment. Herd size and composition are given in Table 2.

The average herd size is significantly large in Kigoma compared to Kagera because majority of Ankole cattle keepers in Kigoma still practice traditional pastoralism that is normally characterised by large herds. To the contrary, Ankole cattle keepers in Kagera Region are agro-pastoralists and practice other off-livestock activities as source of livelihood. Such economic activities diversification observed within Ankole cattle keepers in Kagera Region has decreased land available for grazing and hence forced them to reduce their herd size. Helen *et al.* (2003) also reported that in Uganda Ankole cattle keepers are now changing from pastoralism to agro-pastoralism, eventually keeping fewer animals due to land shortage.

Bulls made up 3.6% and 3%, while cows and heifers comprised 81% of the herd in Kigoma and Kagera regions respectively. The ratios for breeding bulls as related to cows and heifers indicated the importance and requirement of milk as staple food to Ankole keepers as other pastoralist societies. On the other hand, most of Ankole herd structure (bull-female ratios) indicates the applied knowledge in mating control regarding cattle breeding.

**Table 2: Average herd size and herd composition**

Category	Kagera region			Kigoma region		
	Mean	Min	Max	Mean	Min	Max
Herd size	72	17	207	191	8	578
<b>Livestock kept</b>						
Pure Ankole breed	54	25	82	253	25	1010
Ankole crosses	25	2	171	12	1	58
Zebu	1	1	6	4	1	21
<b>Pure Ankole cattle herd structure composition</b>						
Bulls		3.00			3.6	
Steers		3.60			3.7	
Cows		48.90			45.8	
heifers		32.30			29.8	
Calves		12.20			17.1	

Herd structure compositions are in percentage.

#### 4.4.2 Division of labour among Ankole cattle keepers' households

Household size is defined as the number of persons preparing their daily meals together, but not necessarily eating together. The study revealed that, in Kagera and Kigoma regions the average household members among Ankole cattle keepers households are 10 people and 16 people respectively. The results were not the same as those reported in Tanzania 2002 census general report (URT, 2004) because at average there are few households engaged with Ankole cattle keeping compared to population at given areas. This implies that, there is distinctive characteristics of both Ankole cattle keepers and Ankole cattle breed. The unique characteristics of Ankole cattle are briefly explained in DAGRIS (2006).

Many members are required in a single pastoralist household for different activities related to animal husbandry practices. The study revealed that in both regions, households have an average of two temporary workers who are mostly doing herding, milking and guarding animals. Table 4 shows activities related to animal husbandry and division of labour (household members responsibilities) among Ankole keepers' societies in Western Tanzania. There was no significant difference in responsibilities between Ankole keepers in Kagera and Kigoma regions.

Like in many cattle keeping societies decisions about breeding, selling and purchasing cattle among Ankole cattle keepers societies are mostly done by males who are also household heads, while other important roles in cattle husbandry including processing milk and selling milk products are only done by female household members. These results are in line with Mwacharo *et al.*, (2005), who also reported that only males make decisions in most activities that influence herd structure and composition.

**Table 3: Division of labour and responsibilities among Ankole keepers in Kagera and Kigoma regions**

Responsibility	Household members involvement in percentage				
	Household head	Spouse	Female child	male child	Workers
Herding	33.33	0.00	0.00	58.33	66.66
Caring for calves	18.33	10.00	0.00	56.66	41.66
Milking	36.66	0.00	0.00	56.66	42.66
Making dairy products	0.00	61.66	0.00	6.66	8.33
Selling animal products	10.00	50.00	48.33	15.00	11.66
Selling cattle	88.33	6.66	0.00	31.66	1.66
Breeding Decisions	86.66	5.00	0.00	30.00	5.00
Purchasing cattle	88.33	5.00	0.00	31.66	3.33
Watering	88.33	6.66	0.00	55.00	55.00
Spraying	40.00	0.00	0.00	58.33	45.00
Guarding	0.00	0.00	0.00	5.00	5.00

Though women process and sell milk products, a significant number of respondents mentioned men; specifically workers and male children (78%) to be responsible for milking in both Kagera and Kigoma region (Table 3). 95% of respondents mentioned milking is done early in the morning and late evening.

#### 4.4.3 Grassland management, water sources, and mineral supplementation

In Kigoma (100%) and Kagera (77%) of the Ankole cattle keepers graze their animals on natural pastures under communal lands. All Ankole cattle keepers in Kigoma and Kagera regions, employ free grazing management system which is a management system for most of pastoralist societies as reported by Mwacharo (2005). Few Ankole keepers (23%) in Kagera (probably influenced by Ankole keepers from neighbour countries of Rwanda and

Uganda) owned and fenced grazing lands. In both regions, no Ankole keepers reported to practice pasture improvement besides rotational grazing .

However, in the workshops, herd separation was mentioned as the only mechanism to minimize grazing competition and control mating. Ankole cattle keepers' control mating during grazing for the health of the breeding bull before breeding season (Fig. 2 and Fig.3). Farmers know the high feed requirement and importance of health for breeding bulls, during dry season. Workshop participants mentioned that, breeding bulls are separated from herds and left to graze with few female animals. According to Mwacharo *et al.* (2005), most pastoralists supplement their animals with mineral salts, whereas agro-pastoralists, in addition to mineral salts, utilize crop residues. The same findings were revealed for Ankole cattle keepers in Kagera Region. In contrary to Mwacharo *et al.* (2005), Ankole cattle keepers in Kigoma Region use specific areas within rangeland with saline soils and therefore take animals to leach the soil for mineral salt supplementatin.

In Kigoma Region, water sources for humans and animals during dry or wet season were rivers, springs, wells, ponds and rainwater. Water sources for human and livestock in Kagera Region during dry or wet season included lake, wells, ponds and rainwater. The distance to water source is much shorter in Kigoma Region (aproximately 1km) compared to Kagera which is more than 5 km. However, in both regions water sources are under communal use. Workshop participants (Ankole farmers) mentiones to take animals at watering point once a day. In Kagera Region, water quality was observed to change from clean to muddy as the water volume decreases, normaly during dry season.

## **4.5 Animal health management**

### **4.5.1 Health services**

Ankole cattle keepers are heartily committed to the health of their animals. The most problematic diseases and other health related problems cost these poor livestock keepers approximately more than 20 UDS per animal per year for veterinary services. In Kigoma and Kagera Regions, 80% of the respondents had access to veterinary service. Public vaccination and veterinary services are the major means of preventing and controlling prevailing diseases. However, the study observed that, the number of veterinary officers in relation to available animals and working facilities regard to animal health services are limited in both regions surveyed.

### **4.5.2 Diseases control**

Diseases are the greatest threats to the realization of the productive potential of cattle herds among pastoralist societies. All respondents have encountered several livestock diseases including Foot-and-mouth disease (FMD), Bovine Contagious Pleuropneumonia (BCPP), Black quarter, Rinderpest and gastro-intestinal infection. According to cattle keepers, the diseases presented are the common diseases in the two regions. East coast fever (70%), followed by Trypanosomiasis (56%), Black quarter (34%) and CBPP (Contagious bovine pleuropneumonia) were mentioned being the commonest diseases in Kigoma and Kagera regions.

#### **(i) Ectoparasites and intestinal parasites**

The preventive measurements taken are very similar in two regions. Control against ectoparasites is done once a week with chemicals spraying whereas drenching is used to control intestinal parasites, which is carried out between 1 and up to 4 times a year. This

implies that, though Ankole keepers are practicing traditional animal husbandry, they are flexible and can adopt some of modern (good to them) animal husbandry practices like the use of right dosage of veterinary drugs. Hence, it is also possible to improve genetic potential of Ankole cattle breed if and only if Ankole cattle keepers breeding objectives and goals are met.

#### **(ii) Tick borne diseases and Trypanosomiasis**

Farmers, who participated in workshops from both regions, mentioned: movement from tick or tsetse fly infected areas, use of different watering points, and separation of suspected sick/sick animals from herds and release of animals for grazing at late hours during the wet season. Also mentioned to apply breeding knowledge through selection and breeding diseased free animals approaches as the traditional methods for controlling different livestock diseases and hence minimizing medication costs. Adekunle *et al.* (2002) also reported the use of traditional methods/techniques by pastoralists in Nigeria in controlling and treating livestock diseases.

In Kagera region, one herdsman indicated a disease condition, which peels off the white skin patches after the animal has eaten a specific plant. According to the herdsman, traditionally the plant is known to be very palatable to animals. To control the incidence Ankole cattle keepers do not take animals to areas known to have such kind of plants particularly during rainy season.

This finding implies that, pastoralists have knowledge in knowing diseases causative agent, however, in contrary to Mwacharo *et al.* (2005), no significant number of respondents either in Kagera or Kigoma regions mentioned about traditional practices for

treating animals. The study revealed that, majority of Ankole cattle keepers depends on laboratory medication to treat animals.

#### **4.6 Breeding goals and strategies**

##### **4.6.1 Comparative advantages for keeping Ankole cattle**

The study generally revealed that, Ankole cattle keepers in Kigoma and Kagera regions keep Ankole cattle and Ankole related breeds for the following reasons (relative importance) in descending order of importance (average ranking); for milk production (0.27), insurance (0.20) and as tradition (0.18). Other reasons and their relative importance for each region are indicated in Table 4. The results are contrary to many findings including Mwacharo *et al.* (2005) regarding the reason for keeping cattle in South-East Kenya on the subject of Maasai pastoralists. This indicates that there are differences in breeding objectives and variation in breeding goals among pastoralist societies.

**Table 4: Ranking of reasons for keeping Ankole cattle breed by importance**

Reason	Kagera region				Kigoma region		
	Ranking	Frequency	Average rank	Importance	Frequency	Average Rank	Importance
Milk production	1	6	0.23	2	9	0.31	1
	2	5			12		
	3	8			4		
Meat production	1	3	0.12	5	2	0.14	4
	2	5			4		
	3	2			5		
Insurance	1	5	0.15	4	10	0.25	2
	2	2			1		
	3	5			9		
Wealth symbol	1	1	0.02	7	-	-	7
	2	-			-		
	3	1			-		
Clan relation	1	-	0.01	8	-	-	7
	2	-			-		
	3	1			-		
Disease resistance	1	-	0.06	6	1	0.06	5
	2	5			2		
	3	-			2		
Beauty	1	8	0.24	1	1	0.04	6
	2	5			1		
	3	6			1		
Tradition	1	8	0.16	3	5	0.2	3
	2	1			6		
	3	4			5		

The average ranking is calculated using an index of a particular reason, the higher the value of the index the greater the importance of the reason it represents.

Ankole keepers are not keeping Ankole cattle because of prestige, rather have their breeding objectives and goals that influence or maintain the genetic pool of Ankole cattle breed. For Ankole keepers in Kagera Region, the result shows that, goal is to meet and

increase food (milk) demand from Ankole cattle while maintaining the genotypic (potentials in milk production) and phenotypic (beauty) characteristics of Ankole breed. For those reasons, milk production and beauty were ranked higher in Kagera Region.

During workshops at both Kagera and Kigoma regions Ankole keepers mentioned that, young household members are allocated to Ankole cattle which to possess in future. The tradition of cattle acquisition, need of milk and the appropriate experience with Ankole cattle, influences the perception of household members among Ankole cattle keepers toward keeping Ankole cattle. Accordingly, Ankole keepers in both regions ranked tradition among three important reasons for keeping Ankole. The traditional implication of the finding is that, Ankole cattle keepers in Western Tanzania are still valuing traditional ways of living and maintaining natural resources as it ensures their endurance.

Insurance was ranked second in Kigoma Region whereas it ranked fourth in Kagera Region. This is because majority of Ankole cattle keepers in Kigoma Region depend entirely on livestock compared to Kagera Region where farmers are also engaged with other income generating activities as discussed in section 4.2.

Insurance involves the ownership of livestock present in the herd, as a guarantee for offsetting shortfalls in earnings and unforeseen expenses in the future (Kosgey, 2004), for instance, livestock and human medical bills. Consequently, owning animals substitutes for paying insurance premiums in rural areas where markets for insurance are absent. However ranked fourth in Kagera region, the study revealed that insurance is among (in overall average) top three reasons ranked by Ankole keepers as the reason for keeping

Ankole cattle in Kagera nad Kigoma regions. The results are also supported by (Mtengeti, 1994) as related to Maasai in Northern Tanzania.

There is a significant difference in ranking the reasons for keeping Ankole cattle between Kigoma and Kagera regions. The differences in breeding objectives relate to animal products needed and environment influence. Also Mwacharo *et al.* (2005) and Petersen *et al.* (2004) in combination revealed that, livestock keepers' perspective of risks, particularly related to the weather, animal health and production may influence breeding objectives.

During workshops, it was observed that Ankole cattle keepers introduce Ankole breed date back 1950 and 1900 in Kagera and Kigoma region respectively. Hence, are more experienced with Ankole cattle management and know exactly the advantages of keeping Ankole cattle breed.

The farmers mentioned beauty, disease resistance, better milk, better meat and workability as the adaptive advantages of keeping Ankole cattle breed compared to other cattle breeds. Livestock keepers mentioned repeatedly-quality milk, beauty and disease resistance as important advantages possessed by Ankole cattle compared to other cattle breeds. For Ankole cattle keepers the beauty of an animal is defined by its horn colour, size and shape and coat colour and pattern. The preferred horn is white, large and forward oriented and the preferred coat colour is dark red. Whereas milk production plays great role in both Kagera and Kigoma regions. In Kagera Region, beauty plays an important role for keeping Ankole cattle. Valuing the beauty shows the traditional attachment of Ankole

cattle keepers towards Ankole cattle breed. Consequently, phenotypic characteristics have great influence in breeding decision practiced by Ankole cattle keepers.

The reasons for keeping cattle, comparative advantages and the traits of preference used for breeding (explained in section 4.4.3.3) identified reflect the multiple breeding objectives of Ankole cattle keepers in Kigoma and Kagera regions. Ankole cattle keepers are practising multiple breeding objectives to meet their demand while maintaining genotypic characteristics of their animals in marginalised land of Western Tanzania. Mwacharo *et al.* (2005) also reported that, livestock keepers in Kenya are practicing multiple breeding objectives being coping strategies due to harsh environment.

#### **4.6.2 Animal preferred**

Ankole cattle keepers were asked to give their vision which breed they would like to keep in the near future. Pure Ankole cattle are still favoured by Ankole cattle keepers in both regions, where 73% in Kagera and 60% in Kigoma intend to keep pure Ankole. Accordingly, the bulls preferred should be dark red in colour, long white forward horn, large in body size, well-structured testicles and active in mating, free from inheritable diseases and close related to ancestors with high milk yield history. Ankole cattle keepers mentioned to prefer female animals with the following characteristics; long-white horn, large in body size, high milk producer, normal teats and of high fecundity. Figure 4 shows the preferred phenotypic characteristics of Ankole cattle bull for breeding



**Figure 4. Characteristics of Ankole cattle bulls mostly preferred and selected for breeding. Photo by N. Byamungu (2005)**

The study revealed that, Ankole cattle focuses on large animals because large body sized animals regardless of sex, fetch high price (200- 250 USD) compared to small animals (100- 150 USD) in local market. For that reason Ankole cattle keepers' breeding objective also takes animal body size into consideration. The study revealed that, Ankole cattle keepers assume or understand that, large size breeding bulls will always produce offspring that grow large; large female animals are determinant of body size of their offspring. According to Falconer and Mackay (1996) this assumption has scientific proof. Therefore, body size was also ranked high as trait of preference and included in combination of traits regarding breeding female animals (Table 5)

The results showed that, Ankole cattle keepers have specific traits of preference that have been using for centuries as breeding strategies and for maintaining the genetic diversity of Ankole cattle breed which they adore mostly. Crossbreeding is rarely or done by Ankole cattle keepers due to external forces including government policies and laws, climate and population changes.

#### **4.6.3 Selection criteria**

The Ankole longhorn, having been developed mainly through natural selection, is an ancient breed belonging to the Sanga group of cattle. The breed is indigenous to central and eastern regions of Africa and is found in Kigoma and Kagera regions of Tanzania. Phenotypically, the breed is characterized by large body frame, long and large horns that curves outward and upward (Petersen *et al.*, 2004).

Household heads, which in all cases were the owners of Ankole herd traditionally are responsible for selecting breeding stock (Table 3), specifically breeding bulls. The most important traits, which reflect, breeding objectives, considered by Ankole keepers when selecting/purchasing breeding bulls were phenotypic features (coat colour and horns), body condition, and milk production referring to dam performance. On the other hand, the most important traits considered by Ankole cattle keepers in selecting female animals as the breeding stock were milk production, fertility and body size. Since milk production is the intersect factor in selecting both males and females animals for breeding, it can be argued as the reason for Ankole cattle producing more milk than all indigenous cattle breed in Africa.

It was observed that all Ankole cattle keepers in Kigoma and Kagera regions control the genetic potentials and phenotypic characteristics of their animals by selecting the best combination of traits regarding breeding stock. In both regions, all the possible combinations are targeting high growth rate (large size animals) and high milk yield. In addition, fertility of cows is also highly regarded. Though heavy bulls are appreciated and muscularity traits included as selection criteria, Ankole keepers associate body condition of an animal with feed availability.

Regarding milk yield, breeding bulls are selected from dam or ancestors with a history of producing more milk. Traditionally and according to their experience, Ankole cattle keepers acknowledged breeding bulls as the determinant of the phenotypic appearance for most herds. Table 5 shows the combination of traits preferred by Ankole cattle keepers and mostly used in selecting for breeding Ankole cattle.

The traits preferred by Ankole cattle keepers in selecting female animals for breeding are highly associated with cow genotypic characteristics including milk yield and fertility. Accordingly, phenotypic characteristics of female animals are less important in society of Ankole cattle keepers and breeding strategies. The combinations of traits in cattle breeding are presented in Table 6.

**Table 5: Traits combination frequently used for breeding Ankole cattle**

Sex	Traits combination	Combination preference
<b>Male</b>	Longwhite horn+ coat colour	High
	coat colour + body condition	Medium
	coat colour + behaviour+ dam performances	High
	Longwhite horn+ coat colour +dam performances	Very high
<b>Female</b>	Body size + fertility	High
	Body size+ fertility +milk yield	Very high

The traits selected were not haphazard, for Ankole cattle keepers, the traits preferred for breeding Ankole cattle are understood to have higher heritability. During workshop, traits for milk yield, coat colour and body size were given higher heritability. However, the use of highly heritable traits for breeding animals does not neglect combination of low heritable or unpredictable traits like fertility, body size and behaviour. Milk yield and most of phenotypic characteristics have high heritability (Falconer *et al.*, 1996).

The breeding decision and reason for keeping Ankole cattle identified in this study in western Tanzania shows that Ankole cattle keepers have multiple breeding objectives as livestock keepers in Kenya as reported by Mwacharo (2005). In view of that, holistic breeding approaches to Ankole cattle breed need to be taken into account so that unique

characteristics of Ankole cattle breed are maintained and breed contribution to Ankole cattle keepers' livelihood improvement reorganized.

#### **4.6.4 Culling criteria**

Culling and selling of male and female animals that missed important traits of preference as a breeding stock have been mentioned to control important genetic composition and performance of Ankole cattle. Ankole cattle keepers mentioned important reasons for culling animals include old age, poor fertility, small size, frequent abortion and presence of heritable diseases. The results are consistent with the findings of Mwacharo *et al.* (2005).

#### **4.6.5 Average figures for reproductive performances of Ankole cattle**

Ankole cattle keepers mentioned on average bulls are between 33 and 35 months old in Kagera and Kigoma Regions respectively, when are used for the first time in mating, but figures up to 60 months were also mentioned. Bulls are kept between 3 to 15 years in the herd before they are replaced by a younger bull (Table 6).

Despite the fact that breeding bulls are kept for a relatively long period in the herd, customary are not allowed to mate their daughters. As revealed in the workshops, traditionally, Ankole cattle keepers try to avoid herd inbreeding by separating animals in relation to breeding bull (sire). However, the approach is not efficient as the herd is only separated during daytime. Furthermore, Ankole cattle keepers mentioned to control mating and inbreeding through castrating or selling male animals with unsuitable traits as per Ankole cattle keepers' preferences.

**Table 6: Average reproductive parameters in bulls**

Parameter	Kagera Region	Kigoma Region
1 <sup>st</sup> service (months)	33 (18-60)	35 (21-54)
Age at disposal (year)	12 (7-20)	10 (7-15)
Duration of service (year)	6 (3-15)	6 (4-11)

Numbers in brackets show range.

There is no significant difference in reproductive parameter concerning female animals in both regions. The average number of calves born per cow is 9 for both Kagera and Kigoma regions. Number of calves per cow are high in relation to duration (10 to 15 years) female animals are retained to the respective herds. The noticed fecundity is also reflected in the selection criteria for cows mentioned by Ankole cattle keepers in both regions. In Table 7 reproductive parameters are given for cows.

**Table 7: Average reproductive parameters in cows**

Parameter	Kagera Region	Kigoma Region
1 <sup>st</sup> mating (months)	30 (21-48)	32 (21-48)
1 <sup>st</sup> calving (months)	39 (21-62)	41 (30-57)
Lactation length (months)	7 (5-13)	8 (4-15)
Calving interval (months)	16 (12-24)	15 (12-24)
Number of calves born	9 (5-17)	9 (5-12)
Age at disposal (year)	15 (8-26)	13 (10-19)

Numbers in brackets show range.

Although farmers do not keep written records about herd, Nakimbugwe and Muchunguzi (2003) pointed-out that Ugandan farmers can trace back the relationships or performances of their cattle as far back as ten generations. Hence, the validity of the data presented in this study is based on the recall and experience of Ankole cattle keepers as related to other livestock keepers. Additionally, as justification to experience with animal husbandry practices, workshop participants for this study mentioned rangeland production trend in relation to current Ankole cattle performance in respective areas for five decades back.

### **Milk production**

There is significant difference in milk production between Ankole herds in Kagera and Kigoma Regions. Ankole cattle in Kagera regions produce more milk compared to Ankole cattle in Kigoma region. Also Petersen *et al.* (2004) reported variation in milk production regarding environment differences. Besides the favour in production environment, Ankole cattle keepers in Kagera have been improving genetic potentials of Ankole cattle through intensive selection within or breeding with genetically potentials Ankole cattle bulls from

different sources including Uganda. In Table 8 the milk production of Ankole cattle for both regions are presented.

This study revealed that daily milk production estimated (6-5 litres/day) for Ankole cattle is considerably higher than daily milk production reported from other tropical indigenous cattle breed under traditional cattle management. Significant difference in milk production among indigenous breed might be due to a higher genetic potential (in milk production) of the Ankole cattle compared to other African breeds (Petersen *et al.*, 2004). In addition, the intensive selection criteria for milk production done by Ankole cattle keepers (section 4.4.3) might contribute to this difference.

**Table 8: Relative Ankole cattle milk production (litres/day) compared to its crosses and TSHZ**

Cattle/breed	Kagera Region			Kigoma Region		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
Pure Ankole cattle	6.96	2	15	5.1	2	10
Ankole cattle cross	4.72	2	10	4.05	1.5	6
Zebu	-	-	-	2.79	1.5	6

Through focus group discussion, Ankole cattle keepers pointed out that calves are separated from herds during daytime and allowed to suckle for the whole night when cows return from grazing. The study revealed that more than 60% of respondents allow Ankole calves for natural suckling for 6 to 12 months in range with minimum of 6 months and maximum of 15 months. Respondents mentioned conception interval and pasture availability as the most important factors that determine age for calf to stop suckling.

#### 4.6.6 Sources of breeding bulls and the use of other breeds

More than 90% of Ankole cattle keepers in both Kagera and Kigoma regions declared to replace breeding stock from respective herds; with exception of few (5%) Ankole keepers in Kagera region who stated to obtain breeding bulls from Uganda. Also a significant number of Ankole cattle keepers mentioned to obtain breeding stock from neighbours, friends or relatives in the same village. None of the Ankole cattle keeper in Kagera or Kigoma regions mentioned other sources of germplasm besides TZSH.

As a strategy for improving Ankole cattle adaptability within harsh environment, mostly in Kigoma region, Ankole cattle keepers frequently have been using Tanzania Short Horn Zebu (TSHZ) cattle breed for crossbreeding with Ankole cattle. This can also explain the low milk off take and rarely crossbreeding practices in Kigoma and Kagera region respectively. The results are similar with that of Falconer (1996) regarding gene-environment interaction and genetic improvement through selection and crossbreeding within breed, also in line with Petersen *et al.* (2004) regarding variation in production environment.

The genetic diversity of Ankole cattle bred for quite long time in Western Tanzania have been maintained through control of mating, less use of external germplasm and intensive selection regardless from the same herd, as revealed in this study. Selecting and using breeding stock from same herd for long time increases chances of inbreeding and reduce genetic performance of a given breed (Falconer *et al.*, 1996).

## CHAPTER FIVE

### CONCLUSION AND RECOMMENDATION

#### 5.1 Conclusion

- i. Ankole cattle keepers practice pastoralism with a very strong traditional relationship with the Ankole breed and would like to continue keeping the breed.
- ii. It is rational and easy for Ankole cattle keepers to practice indigenous selection criteria for breeding their herds since it is a practice handed down from their parents.
- iii. The frequently used or preferred traits for selecting breeding stocks are the same. This reflected the same traditional breeding decision among Ankole cattle keepers in Kagera and Kigoma regions.
- iv. The breeding bulls are selected for their physical appearance, also in line with high milk yield ancestors whereas female animals are selected with regards to high milk production and high fertility.
- v. Given the different roles cattle play in pastoralist societies, this study provides readers the useful information on the traits that should be included in breeding objectives that target genetic improvement and conservation of indigenous cattle breed specifically Ankole cattle breed in western Tanzania.

## **5.2 Recommendation**

Understanding indigenous knowledge of pastoralists societies is fundamental to participatory livestock sector development approaches in Tanzania. However, further steps beyond understanding indigenous knowledge is needed in promoting selected indigenous knowledge. This is because indigenous practices have replication limits, also does not necessarily making development participatory.

This study recommends that indigenous knowledge, practices and experiences should be incorporated in planning, implementation, monitoring and evaluation of livestock related projects in order to realize its potentials in improving and conservation of genetic diversity of indigenous livestock. Hence, further studies are needed to identifying right dosage between indigenous knowledge and external knowledge for improving performances of indigenous livestock.

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## APPENDICES

## Appendix i. Sample of questionnaire used for baseline survey

## Indigenous Selection Criteria in the African Longhorn Ankole Cattle

SURVEY A – Baseline survey

Date:     /     / 2005  
           Day   Month

Enumerator Name: \_\_\_\_\_

Questionnaire Number: \_\_\_\_\_

Farmer name: \_\_\_\_\_

District: (BU Cummune) \_\_\_\_\_

County: (TZ: Ward; RW/BU: Sector) \_\_\_\_\_

Subcounty: TZ Village RW: Cellule BU: Colline \_\_\_\_\_

**Introduction:**

Hello, my name is Noely Byamungu.

I work for an International project done by BOKU University for Agriculture, the International Livestock Research Institute based in Nairobi and Sokoine University of Agriculture in collaboration with Ministry of Water and Livestock Development-Tanzania.

I would like to carry out a study about the description of Ankole cattle. I would like to ask you some questions about your animals, for example about how you care for them, how you choose animals for breeding and what importance they have in your culture.

In future, this information will help in carrying out an Ankole breeding program that is suitable for the needs of farmers.

This information will help majority to understand your life and relationship to Ankole cattle and this might help to prevent the Ankole breed from vanishing in the future. The information you give me will not be passed on or used for any other purpose. I depend on your help very much and are grateful for any information you kindly provide me with.

**A: Household:****1. Age of the household head:**

Name, if not identical with respondent: \_\_\_\_\_

tick

Not known	
< 20 years	
20 to 29 years	
30 to 39 years	
40 to 49 years	
50 to 59 years	
60 to 69 years	
> 70 years	

**2. Sex of the household head:**

tick

Male	
Female	

**3. What is your position in the household (in relation to the household head?)**

Tick

Head	
Spouse	
Brother	
Sister	
Son	
Daughter	
other (specify)	

**4. Did you attend school?**

Primary (Tick)	Secondary (Tick)
-------------------	---------------------

Yes		
No		

**5a. How many members are there in your household?****5b. How many are 16 years or older?****6. How many members over 16 years attended or are attending school? (also list**

**Members when they didn't finish a school level)**

	Number of members
Primary school 1-4	
Primary school completed	
Secondary school	
Further education (specify)	

**7. What are your main sources of livelihood?**

tick

Livestock	
Crops	
Others (specify)	

**B. Management****8. Members of the household who own cattle:**

tick

Head	
Spouse	
Sons	
Daughters	
Others (specify)	

**9. Who in your household is responsible for the following activities:**

	Head	Spouse	Children male	Children female	Other family members	Workers
Herding						
Caring for suckler calves						
Milking						
Making dairy products						
Selling products						
Breeding decisions						
Purchasing cattle						
Selling cattle						
Watering						
Spraying						
Other (specify)						

**10. Number of workers on the farm:**

Permanently employed	Seasonally employed

**C: Animals:****11. Which livestock do you keep? (tick)**

	tick
Ankole cattle	
Ankole crosses (specify)	
Other cattle (specify)	
Sheep	
Goats	
Poultry	
Others (specify)	

**12. How many animals does your household own?**

	Bulls	Cows	Heifers	Steers	Calves
Ankole					
Ankole crosses (specify)					
other cattle					

**13. When do you milk your cows?**

tick

Only in the morning	
Only in the evening	
In the morning and the evening	

**14. What is the average daily yield of peak lactating cows in your household:**

Breed	Yield (liters)
Ankole	
Ankole crosses	
Other cattle	

**15. Until what age do your calves suck milk from the cows?**

Age in months

--

**16. OPEN QUESTION: Why do you keep Ankole cattle?**

Tick all applicable answers Rank the first 3

Milk production		
Meat production		
Tradition		
Insurance		
Wealth symbol (Prestige)		
Clan relation		
Disease resistance		
Walkability		
Beauty		
Other (specify)		

**17. OPEN QUESTION: Does the Ankole breed have any advantages in comparison to other breeds?**

tick

Don't know	
No advantage	
Disease resistance	
Low feeding requirements	
Heat tolerance	
Beauty	
Better meat	
Better milk	
Other (specify)	

**18. Which breed(s) would you like to keep in the future?**

Tick

Ankole	
Ankole crosses (specify)	
Other breeds of cattle (specify)	

**19. How many cattle have entered the herd of the household in the last 6 months including new born calves?**

	Male	Female
Born		
Bought (also in kind)		
Loan (unpaid)		
Lease (paid)		
Exchange (cattle for cattle)		
Gift		
Dowry		
Other (specify)		

**20. How many cattle have left the herd in the last 6 months?  
(including calves!)**

	Male	Female
Sold		
Slaughtered for Home consumption		
Died		
Still birth		
Stolen		
Gift		
Dowry		
Exchange		
Other (specify)		

21. If sold, what was the method of sale?

	Tick
Sold at the market	
Sold to a neighbour	
Sold on farm to a trader	
Sold on farm to a butcher	
Others (specify)	

22. OPEN QUESTION: If culled, what were the reasons for disposal/culling? (tick)

	Male	Female
Size		
Colour		
Temperament		
Disease		
Production performance		
Old age		
Injury, accident		
Infertility		
Other (specify)		

23. What are current prices for different categories of Ankole cattle (breeding animals) (give a range)

Bulls	
Cows	
Heifers	
Weaned calves	

24. What attributes would you prefer when receiving a cattle herd as a dowry?

**D: Products:**

25. What kinds of cattle products do you use/make in your household?

	Home consumption	Sold	Price per unit	Unit
Fresh milk				
Ghee				
Meat				
Hide				
Urine				
Blood				
Horns				
Sour milk				
Manure				
Other (specify)				

**E: Breeding:**

26. Average figures for breeding:

	Age 1 <sup>st</sup> mating (months)	Age 1 <sup>st</sup> calving (months)	Lactation Duration (months)	Calving Interval (years)	No. of calves in lifetime	Age at Disposal (years)
Cow/Heifer						

	Age 1 <sup>st</sup> service (months)	Age at disposal (years)	Duration of service (years)
Bull			

**27. OPEN QUESTION: To you, what are the most important criteria for choosing a cow/bull/heifer for breeding? Please rank the first five of your listed characteristics according to your preference:**

(tick)

	<b>cows</b>	<b>rank</b>	<b>heifers</b>	<b>rank</b>	<b>bulls</b>	<b>rank</b>
Colour						
Horns						
Growth/Body size						
Fertility						
Temperament						
Milk yield						
Disease resistance						
Muscularity						
Longevity						
Mother						
Father						
Other ancestors						
Other (specify)						

**28. From which sources do you obtain breeding animals?**

	tick	tick	tick
	<b>Source</b>	<b>Same village</b>	<b>Other village</b>
Own herd		xxxxxxx	xxxxxxx
Neighbour herds		xxxxxxx	xxxxxxx
Friends herds			
Relatives			
Clan member			
Market			
Other (specify)			

**29. Do you use other breeds for crossbreeding with Ankole?**

(tick)

	<b>Never</b>	<b>Occasionally</b>	<b>Frequently</b>
Friesian			
Other (specify)			

**F: Animal health:**

**30. Do you have access to veterinary service?**

tick

Yes	
No	

**If yes, to which service?**

tick

tick

	Public	Private
Vet		
Paravet		
Other (specify)		

**31. Disease Control**

**Ectoparasites:**

Method	Tick	Frequency	Cost per treatment / herd
None		XXXXXXXX	XXXXXXXXXXXXXXXXXXXX
Dip			
Spray			
Pour-on			
Hand dressing			
Injectables			
Traditional			

If traditional method, specify: \_\_\_\_\_

Other: \_\_\_\_\_

**Intestinal parasite control:**

Method	Tick	Frequency	Cost per treatment / herd
None			
Drench/Systemic			
Traditional			

If traditional method, specify: \_\_\_\_\_  
 Other: \_\_\_\_\_

**Trypanosomosis:**

Method	Tick	Frequency	Cost per treatment / herd
None		XXXXXXX	XXXXXXXXXXXXXXXXXXXXXX
Chemotherapy			
Pour-on			
Traditional			

If traditional method, specify: \_\_\_\_\_  
 Other: \_\_\_\_\_

**32. Please list the main diseases that affect your herd:**

**Are animals treated when sick?**

Name of disease	No	Yes	What treatment	How many cases last six months	Cost per treatment
East Coast fever Ndigana					
Trypanosomiasis Ndorobo					
Black quarter Chambavu					
CBPP					
Homa ya mapafu					
Others (specify)					

**G: Pastures:**

**33. Who owns the land your cattle graze on?**

tick

Household		
Community		
Rented (paid in cash) from		Specify:
Rented (in kind) from		Specify:
Loaned (unpaid) from		Specify:
Other (specify)		

Specify: write down if it is rented/loaned from either a private person or the government

34. Do you fence your land? (also natural fencing like shrubs..)

tick

Yes	
No	
Partly	

35. Do you practise any kind of grassland management?

tick

Yes	
No	

If yes, what kind?

tick

Bush clearing	
Bush burning	
Draining	
Planting pastures	
Herbicides	
Other (specify)	

36. Do you provide salt or other minerals to your cattle

tick

Yes	
No	

37. Sources of water for humans/cattle :

	Humans (tick)	Cattle (tick)	Distance (one way) dry season in km	Distance (one way) wet season in km
Borehole/water well				
Private pond				
River				
Spring				
Pipe water				
Rain water				
Public dam				

**H: Moving:****38. Do you live sedentarily or do you move around?**

Tick

Sedentary		Continue with questions 44-45
Semi-nomadic		Continue with questions 39-43
Nomadic		Continue with questions 39-43

**NOMADIC AND SEMI-NOMADIC: QUESTIONS 39-43****39. How many members of your household move around with your cattle?**

Persons	Number
Whole family	
Men	
Women	
Children	
Workers	

**40. What was the reason for the last time you moved away?**

tick

Drought	
Tradition	
Shortage of land	
Conflict	
Other (specify)	

**41. Does the nomadic lifestyle have a long tradition in your family? Were your ancestors nomads? Where did they live, did they live in the same area as you live?**

--

42. Do you like moving around or would you prefer a sedentary lifestyle?

tick

Like moving around	
Would like to stay in one place	
Other (specify)	

43. What difficulties do you face because of your nomadic or semi-nomadic lifestyle?

**SETTLED: QUESTIONS 44-45**

44. Were your ancestors nomads? Where did they live, did they live in the same area as you live? Who gave up the nomadic lifestyle? What were the reasons for giving it up?

45. Are you content with your sedentary lifestyle or would you like to move around?

tick

Like staying in one place	
Would like to move around	
Other (specify)	

**I: Culture:**

46. Are most of your friends cattle keepers?

Tick

Yes	
No	

If yes, what type of cattle do they keep?

tick

Ankole	
Ankole crosses	
Other breeds (specify)	

47. Would you like your child to marry into a family with...

tick

No cattle	
No Ankole but other cattle	
Ankole cattle	
Any cattle, but in a family with cattle	
Child's decision	

48. What would you give your daughter when she gets married?


49. Are there any celebrations, rituals or traditional actions which involved and still involve Ankole cattle or cattle products? If yes, name and describe them:

--

**Appendix ii. Sample of Questionnaire and Choice cards used for hypothetical choice experiment**

**Questionnaire for choice card experiment**

Date: / / 2006 Day Month
Enumerator Name: _____
Questionnaire Number: _____
<b>Only to enter if no Baseline Survey exists:</b>
Farmer name: _____
District: _____
Sector: _____
Cellule: _____

**1. Age of respondent**

tick

Not known	
< 20 years	
20 to 29 years	
30 to 39 years	
40 to 49 years	
50 to 59 years	
60 to 69 years	
> 70 years	

**2. Sex of respondent**

male	
female	

**3. Did you attend school**

Yes	
No	

**4. What is your position in the household?**  
(in relation to the household head)

Head	
Spouse	
Brother	
Sister	
Son	
Daughter	
Other (specify)	

5. How many members over 16 years are there in your household?

6. How many members over 16 years attended or are attending school? (also list members when they didn't finish a school level)

	Number of members
Primary schools	
Secondary school	
Further education (specify)	

7. Do you expect to get new Ankole cattle for breeding in the near future (purchase/dowry)?

	female	male
Yes		
No		

---

**Only for farmers who were not interviewed in the Baseline Survey!**

---

8. What are your main sources of livelihood?

Livestock	
Crops	
Both	
Others (specify)	

9. How many animals does your household own?

	0	1-10	11-20	21-50	51-150	>150
Ankole						
Ankole-Friesian cross						
Other cattle (specify)						
Other cattle (specify)						

Appendix ii Sample of choice cards

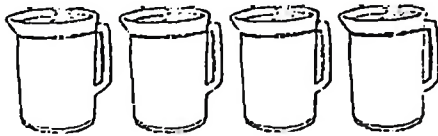
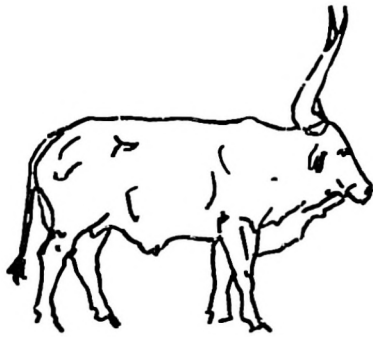
BULL 1.1.



RUHOGO



RWOZI



**BULL 1.2.**

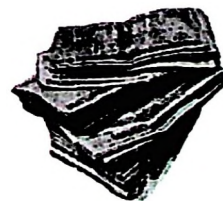
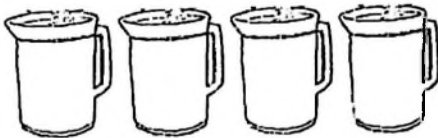
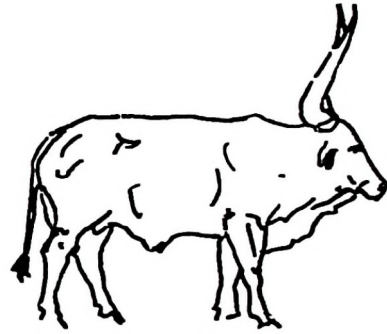
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**RUHOGO**



**RUHOGO**



BULL 1.3.

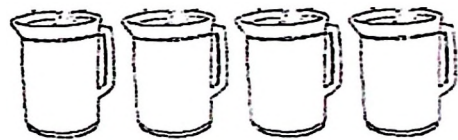
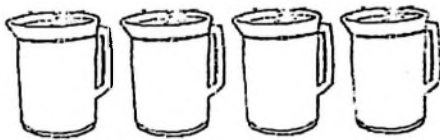
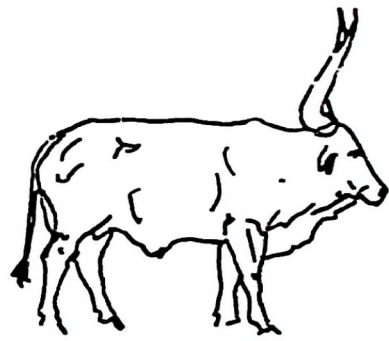
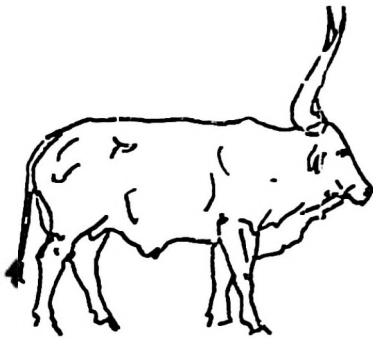
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RWOZI



RWOZI



**BULL 1.4.**

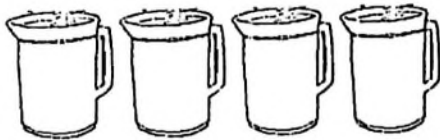
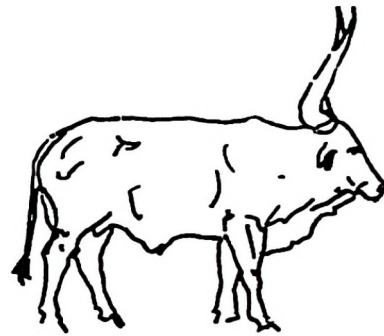
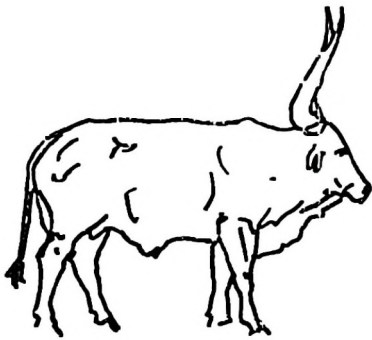
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**RUHOGO**



**RWOZI**



**BULL 1.5.**

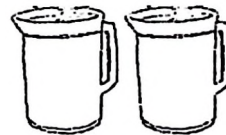
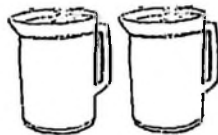
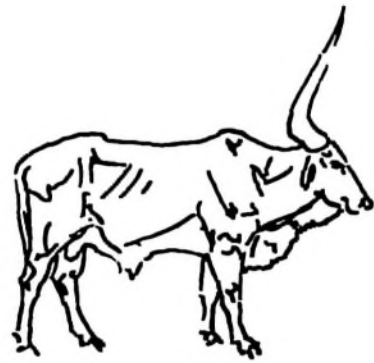
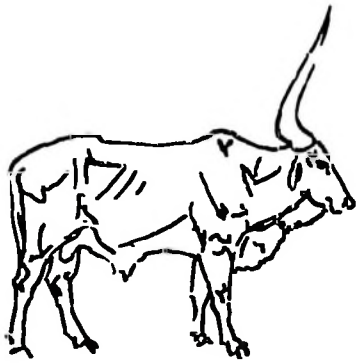
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**RWOZI**



**RUHOGO**

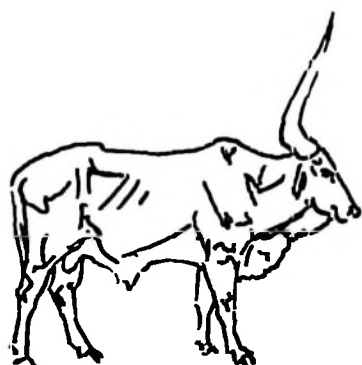


**BULL 1.6.**

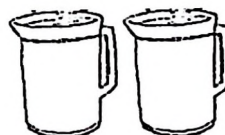
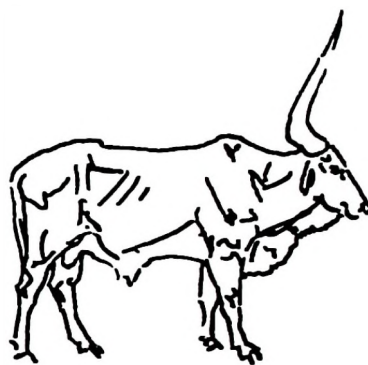
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**RUHOGO**



**RWOZI**



1

TEST COW

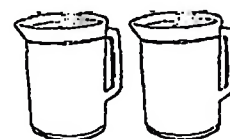
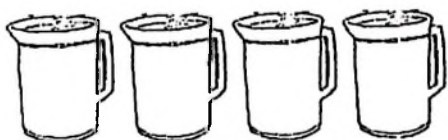
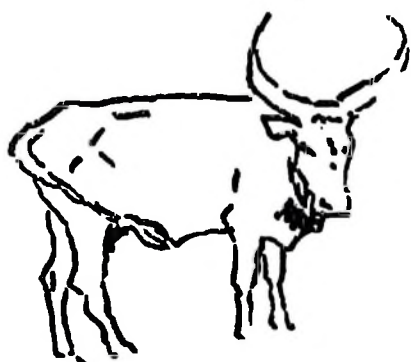
2



BIHOGO



KYOZI



### **Appendix iii. Guidelines for regional workshops**

Start each day with drawing a map of the area, farmers mark their farms, if they move during the dry season with their animals, indicate for how long and what water resource is used (river, swamp, dams). Note distances in miles, km or hours.

#### **1. Seasonal calendar**

Dry/wet season

Crop production: which crops, time of planting and harvesting

Livestock:

- movement of animals
- mating season
- calving peak, if no clear mating season
- milk supply for family
- milk and other milk products sold on the market
- slaughter animals
- spraying and deworming

#### **2. Breeding practices**

Who makes the breeding decision in the household?

Bull:

- for how long is a bull kept in the herd
- is bull allowed to mount his daughters
- origin of bull (own herd/other herd)
- important traits

how many bulls/cows

what happens with bulls which are not used for breeding (sold/castrated)

cow: - origin of cows (do farmers buy sometimes cows, dowry)

for how long is a cow kept in the herd

Reasons for culling cows (low fertility – long calving interval; low milk yield, bad horn shape, bad coat colour.

#### **3. Sedentarisation, historical mapping**

Draw a time line indicating the following importance events:

1900s: Construction of central railway

1918: End of First World War

1961: Independence

1964: Zanzibar Revolution

1978: Tanzania- Uganda War

1985: Nyerere J.K. out of power

1992: Start of Multipartism system in Tanzania

Ask farmers: - when did they come to this area.

why

with which cattle type

acquiring of land in the area

how and when did breed change/when acquired crosses

how land was acquired

Make a list of exotic cattle breeds used in the area, when were they introduced to the area and the trend of numbers (increase/decrease/stable)

Make a list of indigenous cattle used in the area, ask about trend

#### 4. Management/Behaviour of animal

##### *Moving herd*

- position of the bull and related traits
- position of cows and related traits (old/young, strong/sick,...)

##### *watering herd*

##### *herdsmen*

- sex and age of herdsman
- number of herdsmen/herd
- duties of a herdsman (control the speed of the herd, keep animals together,...)

##### *social interaction*

- animal – animal –interaction (friendly, fights)
- animal – human – interaction (brush,...)

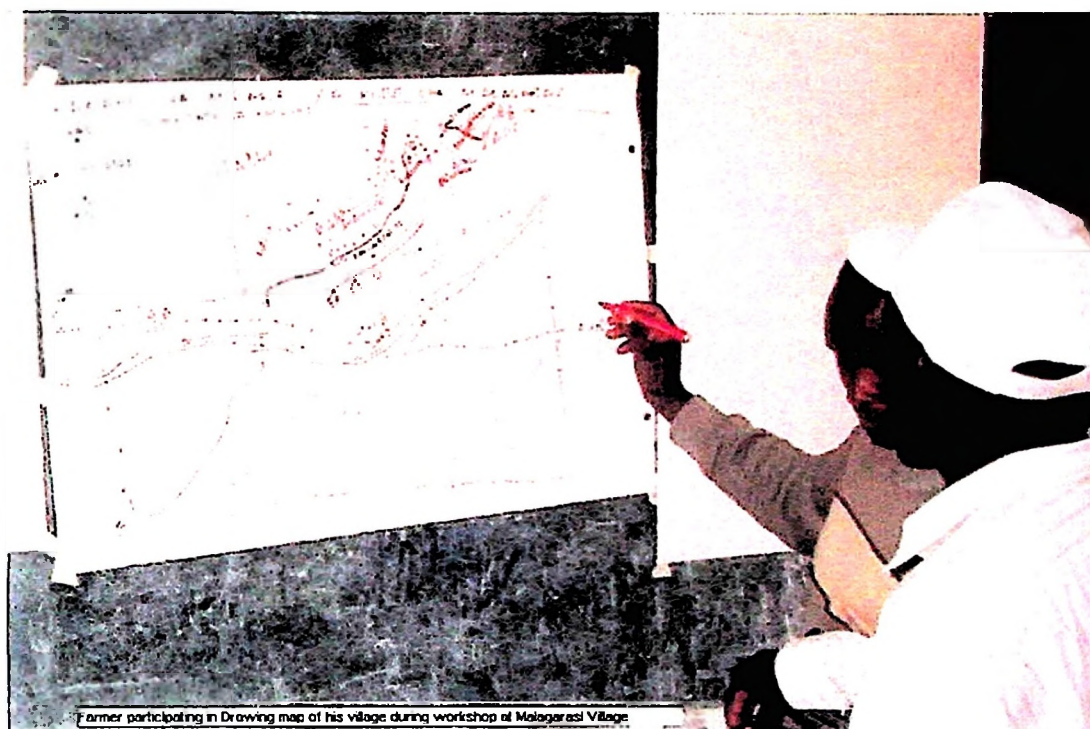
##### *Behaviour at milking*

- capturing of animals for milking: how is it done
- are ropes often used, why
- how do you make a young cow familiar with milking which has its first calf

##### *Behaviour around calving*

- do you separate cow from herd
- what happens if a cow does not accept its calf, is it often a problem
- what is done after birth; do you help the cow and the calf
- do the calves go with the herd grazing or do they stay behind
- where are the calves kept during the night
- how is the weaning done and when

If there is time left and farmers have experiences with crosses, ask farmers to compare pure Ankole with Ankole crosses.

**Appendix iv Ankole cattle keeper participating in village workshop**

Farmer locating his homestead and distance to watering point and movement when searching for pastures during village workshop. (Photo by: N. Byamungu.2005)