

**FACTORS INFLUENCING PRODUCTIVITY OF DAIRY GOATS IN LAIKIPIA
COUNTY: A CASE OF SMALL SCALE DAIRY GOAT FARMERS IN
LAIKIPIA EAST DISTRICT, KENYA**

BY

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**A RESEARCH PROJECT REPORT SUBMITTED IN PARTIAL FULFILLMENT FOR
THE AWARD OF DEGREE OF MASTER OF ARTS IN PROJECT PLANNING AND
MANAGEMENT OF THE UNIVERSITY OF NAIROBI**

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DECLARATION

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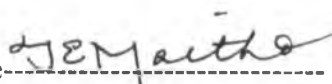
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DEDICATION

This study is dedicated to my loving daughter Patricia and son Arthur for their love and encouragement without which it would have been difficult to pursue this course.

ACKNOWLEDGEMENTS

I thank my supervisor Prof. T. Maitho for his professional and technical guidance, Dr. C. Gakuu for training and guidance and the entire team of lecturers that committed their time during the research seminar.

I thank the Director of Veterinary Services for giving me the opportunity to undertake my studies the Ministry of livestock staff of Laikipia East District for their support and provision of relevant District information

Further, my appreciation goes to the Library staff of the University of Nairobi, for their guidance in the use of e-library. Library staff of the International Livestock Research Institute (ILRI) for allowing me access to their library.

I also wish to thank Mr. Wilson Wachira of Laikipia Dairy Goat Association and his assistant Ms. Catherine Waruguru and Mr. Samuel Karuri, the LEDGA Project coordinator for their time and information.

My appreciation also goes to my colleagues and fellow students for critiquing my work and members of my family for their moral support.

Several other people have played a role in one way or another and they deserve to be acknowledged. It is however not possible to mention everybody and my appreciation goes to all for every single role they played.

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ABBREVIATIONS AND ACRONYMS

AI	Artificial Insemination
ASAL	Arid and Semi Arid Lands
CTA	Technical Centre for Agricultural and Rural cooperation
CCPP	Contagious Caprine Pleural Pneumonia
DAGRIS	Domestic Animal Resources Information System
DHIA	Dairy Herd Improvement Association
DGAK	Dairy Goat Association of Kenya
DLPO	District Livestock Production Officer
DVO	District Veterinary Officer
FAO	Food and Agriculture Organization
ILRI	International Livestock Research Institute
KARI	Kenya Agricultural Research Institute
LEDGA	Laikipia Dairy Goat Association
MoLD	Ministry of livestock Development
PPR	Peste des Petite Ruminants
SPSS	Statistical Package for Social Scientists
STAT	Statistics
USA	United States of America

ABSTRACT

Dairy goat farming is emerging as a high-return option for Kenyan small-scale farmers. Although faced in some regions by marketing and distribution challenges, the sector soars in some regions of the country especially the high potential areas of the Kenyan highlands. Dairy goats were introduced in Laikipia district in 20005. The industry is however growing at a very slow late .The potential of the dairy goat is highly unexploited in the district. There is no dairy goat or any formal or informal marketing of the goat milk. There is however a cattle dairy and camel dairy but none has a link with the goat industry. The district has potential market outlets and is endowed with a diversity of different people from different cultures and is a tourist hub. This study sought to establish factors that could be influencing productivity of dairy goats in Laikipia East District. The study examined the management practices, including disease and pest control, breeding and access to markets. The population of study was a proportionate representative sample of dairy goat farmers from the study area. A semi structured questionnaire was used to obtain primary data from the dairy goat farmers through face to face interviews. Interview guide were also used on the district staff. Secondary data was obtained from the Ministry of Livestock Development Annual reports, other District reports, journals, books and other relevant literature reviews. Descriptive statistics were used to analyze data. Frequencies, percentages and mean were used to present the data. Multiple regression analysis was used to test relationship among variables (independent). Statistical package for social sciences (SPSS) was used to code, enter and compute the measurements of the multiple regressions for the study so as to test relationship between productivity and the four variables (independent). The data findings analyzed showed that taking all other independent variables at zero, a unit improvement in dairy goat management will lead to a 0.613 improvement in productivity of dairy goats. A unit improvement in breeding programme will lead to a 0.489 increase in productivity of dairy goats; a unit increase in market access will lead to a 0.292 improvement in productivity of dairy goats and a unit improvement in diseases and pests will lead to a 0.325 improvement in on productivity of dairy goats. This infers that dairy goat management contributes more to the productivity of dairy goats followed by breeding programme. Further, these only explained 72.07% of the productivity and recommended further research to investigate the other factors (27.93%). The study will be useful to the policy makers, farmers and other relevant stakeholders.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Goats form an integral component of the livestock sector in Kenya and the goat population is estimated at 27,740,153 million (Population census, 2009). They are spread throughout all the agro-ecological zones of the country. In particular, goats are suitable for small scale poor farmers as they are cheap to acquire compared to cattle, they require little land, they reproduce quickly, and they are able to feed on a wide range of forages. Goat rearing is therefore an important activity for the income of poor farmers under the mixed crop-livestock production systems that are commonly practiced in Kenya.

Dairy goat development in Kenya started in the mid 1950s, with the introduction of exotic dairy goat breeds. Major projects to improve the dairy goat sector were not realized until the late 1970s under United Nations Development Programmes (UNDP) funded and FAO executed projects, which lasted until the mid 1980s. The initial projects were mainly government station-based, and aimed at multiplying improved stock for distribution to farmers. Due to several technical, logistical and financial constraints the station-based projects failed to meet their objectives, and by 1996, despite huge financial investments in this endeavor, only a total of approximately 40,000 improved goats were available in Kenya. Farm - Africa thereafter introduced dairy goats to communities in several areas of the country. Some communities are running successive projects in association with the Dairy Goat Association of Kenya. Other organizations have also introduced dairy goats to farming communities in the country. Dairy goats were introduced in 2005 in the Laikipia County.

Laikipia County covers 9,500km².and borders Samburu County to the north, Isiolo County to the North-east, Meru County to the south, Nyeri, Nyandarua and Nakuru Counties to the southwest and Koibatek and Baringo to the west. It lies between Latitudes 0018” and 0051”North and between. Longitudes 36011” and 37024 ”East. The County has 4 administrative districts namely;

Laikipia West, Laikipia North, Laikipia Central and Laikipia East and lies between ecological zones iii and iv.

Laikipia County has varied land ranging from semi-arid to high potential areas. The main livelihood in the semi-arid areas is livestock keeping. Land use systems are mixed farming, marginal mixed farming, agro pastoral, pastoral, ranching and tourism.

Dairy goats were introduced into Laikipia East district in 2005 through the dairy goat association of Kenya. Several other groups such as Arid Lands, Caritas, World Vision, and Laikipia East Dairy Goat Association (LEDGA) have procured dairy goats for farmer groups in the district. Some goats were donated to the sick and vulnerable groups. The population of goats in Laikipia County is 118,500 (Population census, 2009) out of which the dairy goats' population is 6,400. (MoLD, 2009) and 2,500 goats are found in Laikipia East District.

Dairy goat farming is emerging as a high-return option for Kenyan small-scale farmers, although faced in some regions by marketing and distribution challenges, the sector soars in other nearby regions. Farmers in Meru County are being turned back with their goats' milk from the local milk plant, due to its lack of capacity to sell the milk products onwards. But in Nyeri, where strong marketing channels have been developed, the local processing plant is calling for more milk urgently, even offering high prices. (Daily Nation, 3rd September; 2008) however in Laikipia East District there is very little milk which is being produced or marketed. Laikipia East is Arid and Semi Arid Land, where keeping dairy cattle is a major constraint. However, keeping Dairy goats is a more sustainable enterprise since it requires small land size and less capital investment and it also improves the livelihood of the households through sale of milk and kids, which are usually in high demand.

1.2 Statement of the Problem

The productivity of dairy goats in Laikipia East District has been very low since their introduction in 2005. This is despite the increase in number of farmers who have adopted the technology.

To date there is no dairy goat or any formal or informal marketing of the goat milk. There is however a cattle dairy and camel dairy but none has a link with the goat industry. The district is now endowed with supermarkets with the recent opening of Nakumatt, with the biggest shopping

mall in the county. The district is endowed with a diversity of different people from different cultures and is a tourist hub. There are still several institutions such as the army, air force, hospitals, children's homes and hospital for the aged among others. This creates an unexploited market potential for dairy goat milk, kids and other dairy goat products. Due to suitable range climate, there is a very high potential for the district being source of kids and breeding stock. There is already a high demand from neighbouring and other districts.

The potential of the dairy goat is highly unexploited in the district. Land sizes are relatively larger than those in relatively successful Nyeri County enterprises. The weather is suitable. This notwithstanding, there is to date no single dairy goat product in the market despite this potential. This study therefore seeks to establish factors influencing productivity of dairy goats in Laikipia East District with a view to giving possible explanation for the low productivity and recommendations for improvement.

1.3 Purpose of the Study

This study sought to establish factors influencing productivity of dairy goats among small scale farmers in Laikipia East District.

1.4 The Objectives of the Study

The objectives of this research were

1. To examine the influence of dairy goat management practices on productivity among small scale farmers in Laikipia East District.
2. To establish the influence of level of adoption of breeding technology on productivity of dairy goats in Laikipia East District.
3. To assess the extent to which diseases and pests influence productivity of dairy goats in Laikipia East District.
4. To explore how access to markets for goats and their products influence productivity of dairy goats in Laikipia East District.

1.5 Research Questions

The study was guided by the following research Questions

1. To what extent do dairy goat management practices influence productivity of dairy goats in Laikipia East District?
2. What is the influence of level of adoption of breeding technology on productivity of dairy goats in Laikipia East District?
3. To what extent do diseases and pests influence productivity of dairy goats in Laikipia East District?
4. How does access to markets for goats and their products influence productivity of dairy goat in Laikipia East District?

1.6 Significance of the Study

The study will enhance the understanding of the researcher on the dairy goat sector, and will identify factors constraining the productivity of dairy goats in the district. It will inform on some strategies for sustainable production, extension information gaps, policy on disease and pest control for small ruminants and market orientation for sustainable production. Study will add to the pool of knowledge of the dairy goat subsector, inform policy makers, extension workers and farmers, NGOS, and other relevant stakeholders. It will further enhance the exploitation of the untapped potential and prudent utilization of the range resources in the district and other similar areas. It is a recent experience which requires more awareness creation on the potential of the district for dairy goats.

1.7 Delimitations of the Study

The delimitation of a study are those factors that limit its scope (Mugenda, 2008). This study was confined to Laikipia East district only and focused only on the areas covered by the research objectives.

1.8 Limitations of the Study

Heavy rains would make some roads impassable since tarmac is limited only to the major roads and this would delay data collection. The study was also conducted over a short period of time. Poor record keeping, withholding information and giving incorrect information would further add to the limitation of the study. This was overcome by the researcher being introduced to the respondents by the coordinators of dairy goat groups and DGAK Assistants and the District staff from the Ministry of Livestock. Clear explanations of the purpose of study were given so that informed consent from the respondents was obtained.

1.9 Basic assumptions

The assumptions made in this study were that respondents would be willing to be interviewed, would give true information and that the sample will be representative of the population. The weather situation will be conducive.

1.10. Definitions of Significant Terms

Acaricide	An acaricide is a tick destroying agent.
Agro-ecological Zone	This refers to a land resource mapping unit, defined in terms of climate, landform and soils, and/or land cover, and having a specific range of potentials and constraints for land use.
Antihelmintic	Refers to is a worm destroying agent
Appendix	This is the third generation in the dairy goat breeding process. It has 87.5%of the dairy goat (Alpine, Toggenberg, Saanen, etc)
Breed	A breed is a group of animals of the same species with similar appearance and quality.
Buck	A buck is a mature male breeding goat
Dairy goat	This is the milk producing goat of cross breeds between small East African goat and the exotic breeds like alpiners bred for purpose of milk production
Doe	A doe is a mature female goat
Drug	Refers to a chemical used to treat sick animals.
Extension Service	Informal education given to farmers to in order to improve their farming activities
Foundation	This is the first generation of dairy goat breed and has 50% of exotic blood. It is a cross between the original local goat with a pure bred buck.

Inbreeding	Refers to mating of two closely related individuals than the average of the Population.
Intermediate	This is the second generation of a product of foundation doe with purebred buck
Kid	Is a young one of a goat.
Pedigree	This is the fourth generation breed which is a product of an appendix doe and served with a pure breed of the same.
Productivity	Refers to the level of production or efficiency of production.
Small holder farmer	Refers to a person who owns a small piece of land for farming
Stockist	One who keeps medicines for purpose of sale to farmers.
Vaccine	Disease preventing agent

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter highlights literature review in relation to the objectives of the study. The literature is related to overview of dairy goat industry and the world situation of goats and their milk production, potential of dairy goats, the dairy goat sector in Kenya, breeds and breeding, productivity, effects of diseases on output, training and extension, marketing and constraints to goat development.

2.2 Overview of Dairy Goat Sector

Over the past 20 years a new and growing interest in goat milk and goat milk products has occurred everywhere in the world, notwithstanding the majority of organized goat milk dairy sectors being located in the developed European countries. The industry is not well organized with relatively few situations where it is as organized and controlled as the cow milk industry (Dubeuf *et al.*, 2003). Europe owns only 2.5 % of the world goat herd, but produces 18% of the world goat milk. It is the only continent where goat milk has such an economic importance and organization. The situation varies much between countries. In many regions there are growing opportunities for the marketing of quality goat dairy products. The progress made will depend on good organization on the farm using the best practice production system for the given environment, excellent animal management practices and the quality of the product presented to consumers (Dubeuf, 2007). This market is already competed by sheep milk in the areas where ewes were already milked, and likewise by cow milk.

Compared to a bovine dairy, it is relatively inexpensive and is commonly perceived as being less challenging from a management perspective to start a goat dairy. Dairy goats are not very expensive and their size makes them easier to handle than cows. They require less land and less housing space. Milking facilities can be relatively simple. Low barriers to entry make dairy goats an attractive option for many novice producers (Dietmann and Tranel, 2009).

2.2.1 Population Size and Distribution of goats

True goats do not occur wild in Africa, it is agreed that the ancient and recent goats of the continent were introduced from Asia (Epstein, 1971; Dagrís, 2009). The world population of goats stood at 861.9million (FAO STAT, 2008). The largest number of goats is observed in Asia (59.7%) followed by Africa (33.8%) both accounting for 93.5% of the total number of goats in the world (Aziz, 2010). The largest number of goats in the world is found in china, followed by India, Pakistan and Bangladesh all of who constitute 45% of the world total. In Africa, the largest concentrations are found in Nigeria, Ethiopia, Sudan and Somalia. They are distributed in extremes of climates: from tropical desert, characterized by temperature extremes (0°-53°C) such as in the Thar, Sahel and Negev deserts, with insignificant rainfall and sparse vegetation; high altitude mountain areas up to 2,500 m such as the Hindu-Kush Himalayan region; and the wet tropics with high temperature, humidity, rainfall (3,000-5,500 mm) and abundant vegetative cover, such as those in many parts of South-east Asia. But, the preferred environments are the arid and semi arid regions (Devendra 1999; Aziz, 2010).

2.2.2Milk production

Goat milk represents only 2-2.5%, about 15.2 million metric tons (FAO STAT, 2008) of all milk produced by all the different species in the world. Developing countries produce about 83% of the total amount. The largest amount of milk is produced in India, followed by Bangladesh and Sudan. Spain, France and Greece produce a considerable amount of goat milk among European countries. France has established organized programs for selection, processing and commercialization of goat milk and leads in terms of annual milk production per doe.

Goat's milk competes with cows, sheep, and buffalo and camel's milk. The industry is however not well organized and controlled as cow's milk. The main use is house hold, sale to neighborhood and kid suckling (Dubeuf, 2003; Aziz, 2010), production of cheese and yoghurt (Haenlein, 2004), less than 5% of the total milk produced is marketed (Dubeuf and Boyazoglu, 2009).

2.2.3 Challenges of Goat Sector Throughout the World

Milk goats are present in all countries but they are less supported publicly and academically than other animal production sectors. The economic importance of goats in the Gross National

Products is very low, it is very hard to find enough funding and goat programs have limited means and for short term periods. Further the goat is a small size animal with a low value and general rule is that the input costs must not be greater than the price of the product. The industry is not well organized and controlled as the cow's. In India, sector is marginal despite being the highest milk producer in the world (15%), milk is not well priced and generally produced by lower caste (Dubeuf et al 2004).

There is still a great deal of prejudice and ignorance of importance of goats to farmers in rural areas. Contribution of goats to the rural economy was universally underestimated due to largely informal, mostly untaxed, nature of most goat and goat product marketing. Development of goat in Africa was constrained by political and cultural biases, ignorance of their importance, lack of resources earmarked for them, desperate lack of; breeding stock, information, infrastructure, market linkage and skilled manpower (Peacock, 2005).

2.3 Dairy Goat Industry in Kenya

Kenya is reputed to have the most developed and a thriving dairy industry in Africa. Dairy is one of the agricultural sub-sectors experiencing high growth, estimated at 3 to 4 % annually (National Livestock Policy, 2008). Dairy contribution to national GDP is estimated at 3.8%, which is part of the 10 to 12% from livestock and 40% from agriculture. Milk based enterprises are attractive in Kenya, supporting with over 1.8 million smallholder households engaged in dairy production. The percentage contribution of dairy goat milk to GDP is not known.

Kenya's goat herd was estimated at 27,740,153 million (pop census 2009). Most of these goats were not bred for milk production. Of these the dairy goat herd constitutes of 171, 7 00 (MoLD, 2009). Total goat milk yield in 2006 was estimated at 0.129 million tons (FAO stat 2006). There is no commercial goat milk industry in Kenya; most of the milk produced is consumed by Kenya's pastoral tribes living in arid low agricultural potential areas. However, a principal factor is that the small East African goats which predominate in this region generally do not produce more milk than is needed to raise their offspring.

Table 2.1 A comparison of milk production (tonnes) in sub-Saharan Africa.

Region	Volume of milk produced	Regional distribution %
Central Africa	42,000	1.7
East Africa	1,896,900	77.9
Southern Africa	12,165	0.5
West Africa	485,765	19.5
Kenya	102,000	4.13

(Fao, 2000)

With human population projected to reach 58 million by 2030, the total milk demand projects to 12.76 billion litres. With this milk demand, the balance in milk demand and supply projected for 2010 to 2030 is illustrated in table 2.2

Table 2.2 The projected growths needed between 2010 and 2030 in animal milk productivity in litres per year and (litres/day) for attaining per capita milk consumption of 220 litres by 2030.

Year and growth rate	Dairy cattle	Dairy goats	Camels	Zebu cattle
2010	1800 (4.9)	225 (0.6)	1440 (4.0)	250 (0.7)
2030	4500 (12.3)	476 (1.3)	1870 (5.1)	410 (1.1)
Growth rate (%/year)	4.71	3.83	1.32	2.50
Percentage change (%)	150.0 (151.0)	111.5 (116.7)	29.9 (27.5)	64.0 (57.1%)

(GoK, 2010)

Domestic milk supply at medium growth rate (3.5%) and high growth rate (4.2%) suggest that demand will continue to outstrip supply by 31.8 to 43.5% for medium growth rate and 16.8 to 32.8% for high growth rate. Satisfying the 220 litres per capita milk consumption by 2030 requires strategic actions to more than double milk productivity if the country is to satisfy the growing milk demands from domestic production without unsustainable explosion in population of milking animals kept.

Greatest productivity increases that will be needed in dairy goats by 115.5% corresponds to an average annual growth rate of 3.83%. These will be realized with annual population growth rates of 8.85% for dairy goats from 175,000 to 936,268, A wide range in individual animal productivity of 0.35 to 4 litres for dairy goats indicate room for improvement. (GOK, 2010)

2.3.1 Government Policy

The Kenya Vision 2030 has earmarked increased productivity of crops and livestock as one of the strategies to increase value in the Agricultural sector (GoK, 2007).

National livestock policy (2008) appreciates the nutritional value of dairy goat milk and their production efficiency with respect to their land space utilization and the high potential for development of the dairy goat enterprise but looks at the dairy industry from the perspective of the dairy cow only. The policy recognizes weak research extension linkages and inadequate field staffing levels that have adversely affected livestock production and productivity. Animal diseases and pests control is important for viability and sustainability of livestock subsector, contribute to low productivity and impact negatively to both local and international trade.

To facilitate selection and use of superior sires, farmers will be encouraged to register their animals with the Kenya stud book and to keep proper breeding records to facilitate selection and use of superior sires while availing reliable information in marketing of breeding cows and heifers. Private sector, farmer groups and societies will be encouraged to undertake breeding and multiplication.

2.4 Acceptability of goat products

Goat milk has always been consumed in Kenya especially by pastoral communities in the country. Studies by Kagunyu, Lengarite, Wayua and Shibia (1996) and Boor (1984) in Marsabit and western Kenya respectively revealed that acceptability of goat milk is not a constraint to goat keeping since there were no cultural factors that hindered the adoption of the dairy goats. Boor observed that if the dairy goat project is given the attention it requires it can contribute to food security and generate income to the sedentarised pastoral communities in the study area.

2.5 Productivity of Daily Goats

Productivity when applied to livestock refers to either level of production or efficiency of production (James and Carles, 1996). In any production system, productivity will be uniquely influenced by complex interactions of environmental, biological and socioeconomic variables (Omore, 1998). The variables are interrelated and, therefore, should be looked at holistically to determine their relative importance and how changes in components affect the whole system. In terms of the efficiency of a production system, productivity is a ratio of units of outputs per unit of inputs to the system. This implies that all outputs must be reduced to the same units although the terms used for outputs might be different.

Options for increasing livestock productivity include improvements in nutrition, disease control, management and breeding (Upton, 2000). The farmer cannot, for example concentrate on feeding alone and hope to have a 'good' herd, but should combine good nutrition with disease control, breeding and management such as housing, cleaning, clean milk production and record keeping. In addition, instead of working hard merely cutting and carrying (fodder, crop residues and weeds), farmers should work smarter and try to increase feed productivity by conservation during the wet season when there is plenty; appropriate utilization such as chaff cutting to minimize wastage; other methods of fodder production; introduction of other suitable feed crops such as fodder shrubs and ration formulation. These methods have been recommended by Lanyasunya, et al. (2006) for smallholder areas which suffer the constraint of inadequate land for forage production (Mwanyumba, Wahome, Mwang'ombe, Lenihan and Badamana , 2010).

2.6 Breeds and breeding

Kenya has two indigenous breeds, the East African goat found predominantly south of the equator but widespread in all agro ecological zones and the Galla breed which occurs mainly under agro pastoral production systems predominantly of the northern Kenya. The performance traits in these indigenous breeds are very small so would therefore result in slow response to selection (Davendra and Burns, 1983). Their performances in terms of growth rate and milk yield are very low. Most important characteristic is their adaptability to environments. Exotic breeds especially temperate breeds despite their high genetic merit for growth and milk production do not withstand harsh climatic conditions. Cross breeding between high performing exotic breeds

with adapted indigenous breeds has been utilized to achieve high productivity than breeding of pure bred goats.

Exotic dairy and meat goats have been imported into the country from the 1950s and more rigorously in the 1970s and 1980s though with limited success (Okeyo, 1997). The major exotic dairy goat breeds are the German (Kenyan) Alpines, Toggenburg, Anglo Nubian, Saanen and the Boer is mostly used for meat production. The dairy types are found mainly in the high and medium potential rainfall areas of Kenya. The breed of goat a producer will choose depends on a number of factors, including personal preference, availability of stock and, perhaps most importantly, the intended end use of the milk.

2.6.1 Production Improvement

Important factors influencing production output and income from goats are genetic merit, udder quality, health and marketing, besides feeding. Genetic merit comes from: selection of native goats and Crossbreeding with improved breeds.

Selection of native goats can be very effective, because of the inherent adaptation to the climate, especially if it is tropical, hot and humid, and the resistance to native diseases, insects and parasites. Selection requires regular record keeping of each herd animal in terms of production traits, milk, composition, meat, growth. Haenlein (2002) noted that in the USA this is done through the Dairy Herd Improvement Association (DHIA) record keeping system, which provides monthly individual data on management efficiency and that if it is done on an official, non-biased basis, it provides regular data for sire proving with a certain degree of reliability, which when published annually allows selection of buck semen and doe ova from proven individuals for superior herd selection by anyone domestically or for import by foreign interests.

2.6.2 Crossbreeding of Dairy Goats

Cross-breeding is a way of realizing quicker genetic improvement than by selection, matching genotype with the environment and benefiting from the complementarity of the breeds involved. The benefits that farmers enjoy include faster growth rates and more milk from the cross-bred goats (Ahuya, Okeyo and Muriithi, 2004).

Crossbreeding has the advantage of selecting presumably superior genetic producing ability, but adaptation to climate, diseases, insects and parasites is usually a big, often insurmountable or at least very expensive problem, which may only be solved by continued breeding crossbred offspring rather than purebred parents. In either case it is necessary to realize that improved feeding is wasted if there is no simultaneous genetic improvement of the basic producing ability (Haeinlein, 2002).

Cross bred milking goats have proved to be popular source of cash incomes for households, manure for small holder farmers in medium to high potential zones of Kenya in their assessment of different east African and toggenberg cross breeds where they concluded that $\frac{3}{4}$ toggenberg and $\frac{1}{2}$ east African is the most suitable for production of milk and growth rates thereby recommending upgrading of locally adapted but less productive local goats with exotic toggenburgs (TECA; proven technologies for small holders).

Earlier work done by the Small Ruminants Collaborative Research Support (SR-CRSP) in Kenya clearly showed that goats could produce up to 5.5 litres with little supplementation while the East Africa produce 100mls per day (Ruvuna et al. 1988).

2.6.3 Inbreeding in dairy goats

Inbreeding occurs when two closely related individuals are mated. It reduces productivity and viability of the inbred individuals. Gibson (2002) in his evaluation of the rate of inbreeding and inbreeding depression in dairy goats, observed that inbreeding is increasing at about the same yearly rate and a value of 0.5 % has been acceptable upper value (Nicholas, 1990) and dairy goat producers should be aware of level of inbreeding in their herd and take action to minimize it. Further higher producing breeds such as Alpine, Saanen and Toggenburg had significantly greater depression for average standardized milk, fat and protein yields than lower producing breeds

2.6.4 Artificial Insemination in Goats

Artificial Insemination(AI) has some key advantages over natural breeding in that it eliminates the necessity of keeping one or several bucks on the farm (depending on herd size). Costs of feeding, housing, separate fencing and labor are eliminated. However, heat detection may be

more difficult in the absence of a buck. AI can increase the rate of genetic improvement in the herd, as long as superior bucks are consistently selected. In natural service, the prospective breeder has only the buck's pedigree to rely on, whereas AI bucks should be progeny tested for their transmitting ability of milk and fat percentage, weight gain, type conformation, etc. AI permits breeding of many does on one day when synchronization is practiced. No long drives to top bucks are involved. The danger of transmission of diseases or parasites is greatly reduced. The time of breeding can be more carefully regulated, and the owner knows exactly when the doe was bred, as opposed to pasture servicing by a buck that is allowed to run with the herd. AI induces good recordkeeping of dates of heat, breeding, pedigrees, etc. This will aid in herd improvements and enable the owner to make better culling decisions (Heinlein, Caccese and mith 2011).

2.7 Disease and pest control

Animal diseases constitute a major constraint to livestock production and the safe utilization of animal products worldwide. For the poor, the impact of livestock disease on lives and livelihoods is particularly severe. An outbreak of disease can mean the difference between sufficient food stocks and food insecurity, between having a secure income to the loss of key household assets. The presence of livestock disease also makes it difficult for the poor to participate in local and even the national livestock economy (Perry, McDermott, Randolph, Sones and Thornton, 2002).

2.7.1 Common disease causes

Common causes of diseases of goats can be classified as infectious, parasitic, nutritional, reproductive or due to injuries. Diseases significantly reduce productivity irrespective of the ecological zone. Mugerwa (1996) observed that Contagious Caprine Pleural Pneumonia-(CCPP) and Peste des Petite Ruminants (PPR) are widely distributed diseases which unless properly controlled, can limit animal production over wide areas. Metabolic disturbances like pregnancy toxemia, mineral deficiencies and rickets have occasionally been observed. They are more likely to occur among confined institutional flocks with limited regard to proper house design, emphasizing the role of management system and level on the spectrum and impact of diseases on production.

2.7.2 Effects of disease on output

Direct losses include mortality and morbidity. Overall losses due to livestock mortality in sub-Saharan Africa have been estimated at US\$ 2 billion (de Haan and Bekure, 1991). Losses due to morbidity as reflected by reduced growth, lactation, work output and reproduction (judged by lambing interval, lambing percentage, and delayed puberty etc) are probably of the same magnitude. Diseases alter the value of the animal by changing its conformation or rendering the products unfit for human consumption. Furthermore, substantial revenue is lost annually because of the failure of many potential producers to meet the sanitary requirements of lucrative export markets.

Indirect effects of disease is the inability of farmers or producers to utilize favorable grazing lands or resources, adopt new systems of animal management, introduce more productive genotypes or fully utilize specific animal products such as draft power because the presence of disease increases the fear for subsequent morbidity or mortality. Diseases indirectly affect production through restrictions imposed on animal products as a result of treatment or vaccination, the enforcement of animal movement to the actual slaughter of sick animals or even those in contact. Where animals are restricted in their movement, it is not uncommon for overgrazing to follow as another complication (Mugerwa, 1996).

Control and prevention of infectious diseases in sheep and goats should be aimed at reduction of pathogenic agents in the environment through non-immune prevention measures and provision of an adequate level of immunity in animals primarily through vaccination. Good management (sanitation, ventilation, temperature, feeding regime) certainly has a great influence on the susceptibility of animals to infection (Franz and Nguyen, 1997).

2.7.3 Parasite control

Parasites, both internal and external are the most important health concerns for goat health and productivity. Good parasite control programme should be initiated as soon as the first animal is obtained. Parasites grow in numbers and build up in closely eaten grassy areas near the goat house. Inside the animal may interfere with nutrients, cause diarrhea or result in poor performance of the animal.

Kiura and Mwamachi (2003) observed that lack of funds, limited awareness and inaccessibility of veterinary staff are factors that cause farmers to control helminthes and external parasites in a sub-standard manner. They noted the need to create awareness and to train farmers on proper use of anthelmintics and acaricides.

2.8 Marketing of Goats and Products

Informal survey in developing countries shows that probably less than 5% of the total milk is traded. Thus, the statistical data do not show an exact view of the economical importance of this sector and is not as organized and controlled production sector as is the case for cow milk.

The dominant presence of dairy cattle and their milk products makes it difficult for breeders and managers of dairy goats and sheep enterprises to sustain a competitive niche in the market place and to receive sufficient research and proportional support. Economies of scale for dairy cattle over small goat and sheep in labor costs, in many countries there are organized governmental support and promotion of dairy industry have dairy goats industries which exist and thrive without support (Redfern et al.1985).

Demand for animal products has been increasing rapidly in Bangladesh due to income and population growth and urbanization (Jabar, et al, 2005). The expanding market has the potential to create income and employment opportunities for small-scale and poor livestock producers if they can produce and sell market-demanded products at competitive costs and prices. This opportunity may be lost if investment, fiscal and capital market policies are distorted in a way that favor large-scale producers

Distance to market significantly reduces milk sold particularly in rural areas. Use of informal market channels also contributed to high output and sale in rural areas. House hold size significantly reduces the amount sold and also where house hold has more children below working age who do not contribute to farm labor but significantly increase household consumption. The unit price also has significant influence on milk sold. Study by Omiti, Otieno and Nyanauba (2009) further demonstrated that peri urban areas had a higher market orientation than rural villages who sell mainly at farm gate and rural markets. Further market information

plays a significant role in farmer's decision on how much output to put to the market depending on prevailing price and nearness to the market outlet

Goats are good browsers and allowing them to consume plants containing aromatic or flavor compounds can impart the smell or flavor to the milk or cheese there by providing an opportunity to generate unique speciality products.

Goat producers must also realize that income from the kid goat crop is important so in addition the producer must have a kid goat marketing strategy. Muba (2008) observed high sales of kids with farmers selling even up to ten kids , and average milk prices being 65 Kenya shillings , sale of manure at 1,800 shillings per ton proving that dairy goats can be a viable source of income. He however noted that only 12% was marketed and rest home consumed in his study in Murang'a South.

Improving market access of livestock producers provides incentives to adopt technological interventions that improve livestock productivity, which in turn improves market success. Zelalem (2000) proposed that access to local market is the most important economic determinant to adopt technologies. Further; improvements in productivity and farmers' income depend largely on adoption of technologies and marketing support. There is growing evidence that major factor explaining low adoption of technology in Africa is lack of appropriate institutional and policy support. Adoption of improved technologies is strongly affected by policy environment like input supply, market, credit and price policies. A value chain approach is required for development efforts to succeed.

2.9 Training and extension

Extension services can be organized and delivered in a variety of forms, but their ultimate aim is to increase farmers' productivity and income. According to Anderson and Feder (2003) productivity improvements are only possible when there is a gap between actual and potential productivity. They suggest two types of 'gaps 'contribute to the productivity differential – the technology gap and the management gap.

Extension can contribute to the reduction of the productivity differential by increasing the speed of technology transfer and by increasing farmers' knowledge and assisting them in Improving

farm management practices (Birkhaeuser, Evenson and Feder, 1991; Feder, Murgai and Quizon, 2004b).

Additionally, extension services also play an important role in improving the information flow from farmers to scientists (Anderson, 2007; Birkhaeuser et al., 1991) (3ie Synthetic Reviews S-R009 Protocol Jan 2010). In order to sustain the interest and motivation of the rural population - particularly women - towards their economic empowerment, their felt needs should be addressed (Farinde and Ajayi 2005). AETPs' failure to adapt farmers' perceived training needs led them to seek information from unofficial sources. Rezvanfar Moradnezhai and Vahedi (2007) discovered that most of the farm women depend on friends, husband, neighbors and other native sources like local leaders and educated people for their information needs. Besides, other studies (Chalermphol and Shivakoti 2009 and Kibwika et al 2009) confirm that information exchange within rural communities is indicated as one of the most common responses to farmers' cognitive needs.

Although the importance of local knowledge should not be underestimated, these channels of information are unable to supply farmers with new knowledge, focused on specific production's issues. Knowledge is constantly getting old, besides learning is a continuous process. Therefore the demand of farmers for new knowledge should always remain provided.

Gizaw, Tegegne, Gebremedhin and Hoekstra (2010) recommend orienting livestock extension service delivery based on farmers need and perceptions will increase adoption of technology. Technical interventions include control of major diseases a major cause of morbidity and mortality affecting offtakes. Institutions that deal with livestock education, research, development, and credit may need to be oriented for a targeted and appropriate technology and dissemination.

2.10 Constraints of goat development in Kenya

Management related issues such as inadequate husbandry, inadequate and ready supply of most appropriate type of breeding stock and how they can be improved, lack or poor supply of inputs, including drugs, feed, water, unavailability of appropriate markets, poor market organization, poor infrastructure and lack of efficient information networks, poor public policy on

environment, poor administration of animal health policies , decreasing farm size, insecurity and livestock rustling among pastoral communities. Frequent droughts and lack of preparedness of such calamities (Ahuya et al, 2005).

Lack of adequate and proper breeding stock to upgrade local goats, the high cost of pure-bred goats, and lack of credit facilities to support dairy goat farming were identified by farmers in Kiambu, Murang'a, Nyandarua and Kericho districts .Further, one of the largest beliefs about goat milk is that it has a specific odour or taste to it. This problem is however only produced by the presence of a buck. The buck has scent glands, which are rather smelly and may cause the milk to have odd taste that many people object to. If the buck is present near the does especially at the time the does are being milked, it is very likely to cause the milk to smell or even taste different (Kinyanjui, Murage and. Mbugua ,2006).

The dominant presence of dairy cattle and their milk products makes it difficult for breeders and managers of dairy goats and sheep enterprises to sustain a competitive niche in the market place and to receive sufficient research and proportional support. Economies of scale for dairy cattle over small goat and sheep in labor costs, lack of organized governmental support and promotion of dairy goat industry (Redfern et al.1985).

2.11 Conceptual Frame Work

According to Mugenda (2008) a conceptual framework is a concise description of a phenomenon under study accompanied by a graphic depiction of the major variables of the study. It establishes a perspective through which the researcher views the problem.

Factors influencing productivity of dairy goats among small scale farmers in Laikipia East District

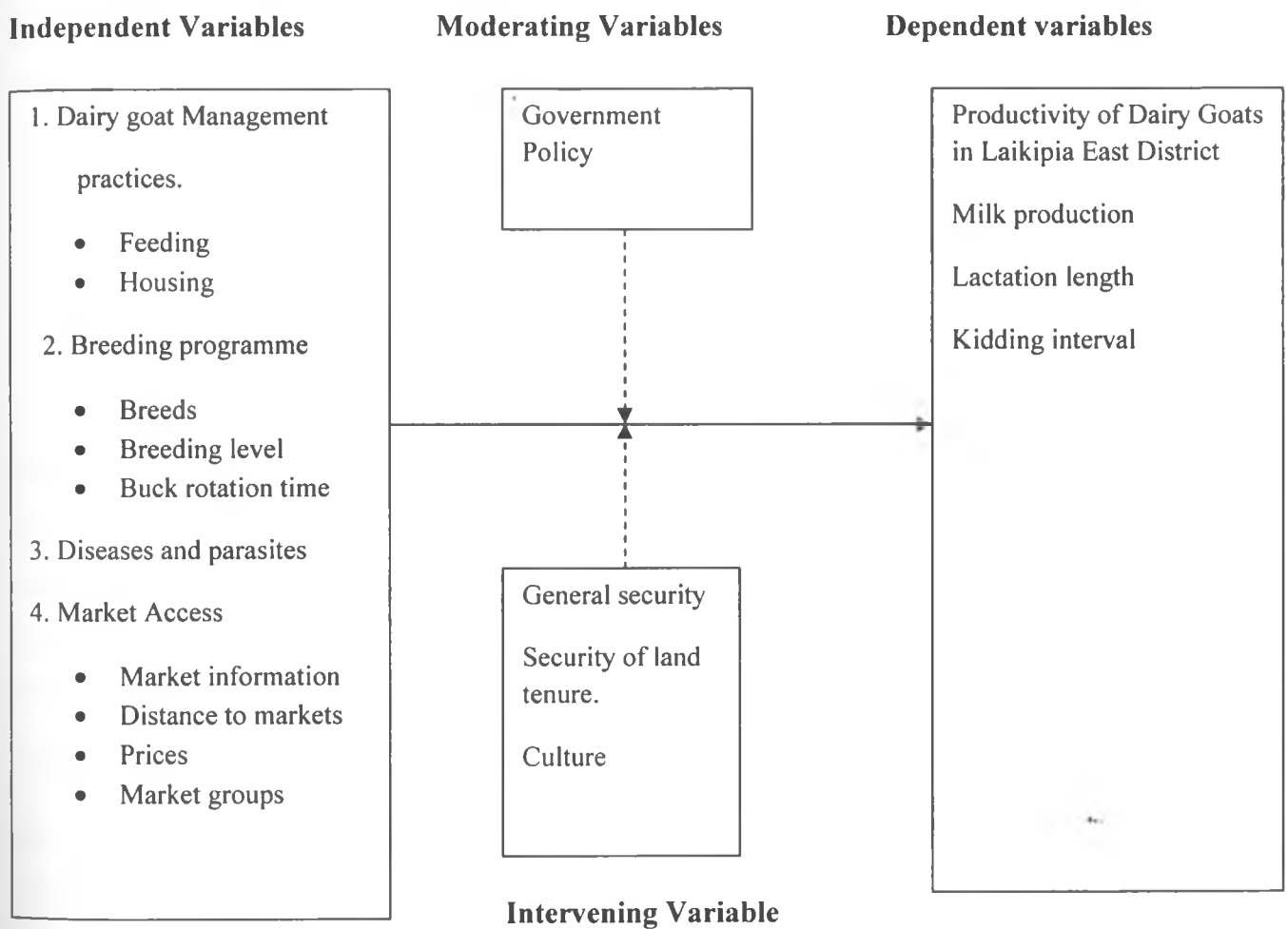


Figure 1: Conceptual Frame Work

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter covers the research design, the study area, target population, sample and sampling techniques, data collection methods that were used in the study and ends with. Data analysis procedures.

3.2 Research Design

The research design was descriptive. Descriptive studies are conducted in communities to establish the extent of issues. They provide foundation upon which correlational and experimental studies emerge. In descriptive studies variables with greater dispersion indicate disparities within the communities and provide important clues that investigator should focus on (Mugenda, 2008). In depth inquiry was conducted using pretested questionnaire to gather household data relating to opinions, attitudes, practices and perceptions on dairy goat farming. In addition any written records were also used where available.

The research methodology was used to gather information on factors which could be responsible for the level of productivity of the dairy goats. This was done without any manipulations by the researcher before or during the study. The information was thereafter summarized, analyzed and interpreted thereby providing opportunity to explore the various aspects of the research questions.

3.3 Study Area

The study was conducted in Laikipia East District of Laikipia County. For purposes of this study, the district was deemed to be the previous central division of former Laikipia District. This was for purposes of data collection since the new district had no data but the 2009 population statistics and administrative areas were be used. The district has an area of 1861.3sq km. and receives rainfall in the range of 800-1200mm and annual temperature ranges from 16° c -26° c

The District has 2 divisions, 5Locations and 12 Sub locations. The study include all the locations where the dairy goats are reared. These are Mia moja, Umande, Nturukuma, Likii, Nayuki town,

Sweet waters, Ngenia, Naibor, Kariunga, and Muramati. The district lies between ecological zones 3 and 4 and Land use system includes ranching, sedentary settlement and pastoralism .Sixty percent of the district economy is supported by livestock production activities.

3.4 Target Population

A population can be referred to as the entire set of relevant units of analysis. The target population for this study was farmers who were engaged in dairy goat farming during the study and who owned at least two goats. These dairy goats are distributed in different groups. There are 46 groups with a membership of 1175 households. Laikipia East District has a goat population of 30,400 of which 2,500 are dairy goats (Population census, 2009).

3.5 Sample size and Sampling Procedure

The researcher used cluster sampling technique by using 46 groups as clusters for the small holder dairy goat farmers. This was due to the fact that the population was large and every member belonged to a group. A sample of 170 households was obtained through proportional random sampling from each cluster. This number of household heads was deemed adequate since Israel (1992) recommended a minimum of 169,would be adequate for a population of 1000 with $\pm 7\%$ precision Levels Where Confidence Level is 95% and $P=.5$. A comprehensive list of goat rearing household heads was obtained from the dairy goat groups' coordinators. The study was restricted to farmers rearing dairy goats.

Table 3.1 shows the number of households keeping dairy goats and the sample taken per location.

Table 3.1 Sample size of the study

Sub Locations	Population	Sample size	Percentage
Mia moja	250	36	21.2
Umande	200	29	17.1
Naibor	100	14	8.2
Sweetwaters	250	36	21.2
Nturukuma	75	11	6.5
Likii	75	11	6.5
Town	75	11	6.5
Muramati	50	7	4
Kariunga	50	7	4
Mukima	25	4	2.4
Endana	25	4	2..4
Total	1175	170	100

3.6 Data Collection Methods

The researcher used the letter of Authorization from the Director of Veterinary Services in order to get assistance from the ministry of livestock development offices at the District level. Appointments were be made with house hold owners during preliminary visits where purpose of the study was explained and informed consent sought. The researcher used both questionnaire and observation method of data collection. The researcher also used focus group discussion with the Ministerial Staff. Extra data volunteered by the respondents was recorded in the survey book and further contributed to primary data.

Primary data was solicited from the farmers through use of semi structured questionnaires which included; Farmers bio data, name of the farmer, gender, age, level of education, farm size and flock size. Management practices, Breeding practices and level of breeding Disease and pest control, Training and extension, Market access and challenges faced by the farmer.

Secondary data was derived from District annual reports, Laikipia East Dairy Goat Association Annual reports, Dairy Goat Association of Kenya (Laikipia), Journals of similar research from both local and international organizations, books and other related literature

3.6.1 Validity of the Research Instruments

Validity is the degree to which results obtained from of data actually represents the phenomenon under study.(Mugenda and Mugenda 1999) To ensure that the instruments would accurately measure the variables of interest to the study, each of the items in the questionnaire was discussed with peers, research supervisors and other lecturers in the field of project planning and management. Attention was given to the specific study objectives. This was to ensure the inferences made will be appropriate, meaningful and useful. Any necessary modification was done. The questionnaire was tested in a pilot study and adjustments were made.

3.6.2. Reliability of the Research Instruments

Reliability refers to the consistency of scores or answers from one administration of an instrument to another, and from one set of items to another (Mugenda, 2008). To ensure consistency of the questionnaire, it was pre tested using a purposive sample of 20 dairy goat farmers in Laikipia central district that borders Laikipia East district. This number was chosen since it the smallest6 number that can yield meaningful results on data analysis in a survey research (Kathuri and Pals, 1993). The district was chosen by the researcher because it had similar agro ecological conditions as the study area. Reliability was achieved through test retest technique

3.7 Methods of Data Analysis

The data which was collected was analyzed using descriptive statistics. The data was categorized, ordered and analyzed by using descriptive and analytical methods. Tables, means, frequencies, standard deviations, and percentages were generated for meaningful interpretation of study objectives.

In addition, the researcher conducted a multiple regression analysis so as to test relationship among variables (independent). The researcher applied the statistical package for social sciences (SPSS) to code, enter and compute the measurements of the multiple regressions for the study.

3.8 Operational Definitions of Variables

TABLE 3.2 Operationalization of Variables

Objective	Independent variable	Indicators	Tools for data collection	Level of scale	Type of analysis
1.To examine the extent to which management practices influence productivity of dairy goats	Management practices	Number of farmers undertaking right management practices vaccination programme Right worm control programme Right tick control programme	Questionnaire Interview guide observation	Ordinal	Descriptive Means Frequencies Percentages Regression
2. To establish the influence of level of adoption of breeding technology on productivity of dairy goats.	Breeding technology	Number of cross bred animals in the flock, Level of adoption as, fl, intermediate, apex, pedigree.	Questionnaire observation	Ordinal Ratio	Descriptive frquencies Percentages Regression
3. To establish extent to which diseases and pests influence productivity of dairy goats.	Diseases and Pest	Number of diseases reported in the farm, Frequency of occurrence. No of deaths	Questionnaire	Ratio	Descriptive Percentages regression
4.To assess how access to markets influence productivity	Access to markets	Distance to markets. Volume of milk marketed, Number of kids sold. Number accessing market information.	Questionnaire	Ratio	Descriptive Percentages Inferences

To establish Productivity of dairy goats in Laikipia East District	Dependent Variable	Tools for data collection	Indicators	Level of scale	Type of analysis
	Milk production per day	questionnaire	Volume of milk produced per day	Ratio	Frequencies Percentages
	Lactation length	questionnaire	Number of days	Ratio	Frequencies Percentages
	Kidding interval	questionnaire	Duration in days	Ratio	Frequencies Percentages
	Mortalities	questionnaire	Number of dead goats	Ratio	Frequencies Percentages

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter presents data analysis, presentation and interpretation of the results of the study of factors influencing productivity of dairy goats among small scale farmers in Laikipia East District. This was based on the objectives and the research questions as stated in chapter one.

4.2 Return Rate of Questionnaires

The data targeted a sample of 170 respondents from which 162 filled in a response rate of 95.3%. In total 8 respondents were not available to fill the questionnaire even after repeated visits. This response rate was excellent and representative and conforms to Mugenda and Mugenda (1999) stipulation that a response rate of 50% is adequate for analysis and reporting; a rate of 60% is good and a response rate of 70% and over is excellent.

4.3 Demographic Information

The first section gives a description of social and demographic characteristics of the dairy goat farmers in the study area. This is followed by more focused analysis of the factors influencing productivity. The findings are presented first by using descriptive statistics and then analyzed using inferential statistics on the basis of the research question being answered.

4.3.1 Gender of respondents

Table 4 shows the gender categories of the farmers in the area of study.

Table 4.1: Gender of respondents

Gender distribution by sex	Frequency	Percentage
Male	62	38.3
Female	100	61.7
Total	162	100.0

The findings in the above table show the gender of the respondents. From the findings, the study established that the majority of respondents were females as shown by 61.7%, while males were 38.3%.

4.3.2 Age of respondents in years

Table 4.2 shows the age of respondents in years

Table 4.2: Age of respondents in years

Age of Respondents	Frequency	Percentage
18-28	4	2.5
29- 38	13	8.1
39-48	37	23.1
49-58	58	36.3
>59	48	30.0
Total	160	100.0

The respondents were also asked to state their age bracket. On the age of the respondents, the study found that the majority of the respondents (36.3%) were between 49-58 years, 30% were more than 59 years, 23.1% of the respondents were 39-48 years, 8.1% were aged between 29- 38 years while a small proportion of respondents as indicated by 2.5% were between 18-28 years old. This depicts that goat keeping is mainly an activity for the aging and is very rarely practiced by the youth.

4.3.3: Highest level of education of household heads

Information on the highest level of education of household head is shown on Table 4.3

Table 4.3: Highest level of education of household heads

Level of education	Frequency	Percentage
None	7	4.4
Primary	80	50.0
Secondary	68	42.5
Post Secondary	5	3.1
Total	160	100.0

The study also sought to establish the highest level of education of household head. According to the findings, the majority of household head had a primary school education as shown by 50% of the respondents, 42.5% had a secondary education, 4.4% had no education while a small proportion of respondents as indicated by 3.1% had a post Secondary as their highest level of education. This shows that most of those who practiced goat keeping were not highly educated which could have an implication in the application of standard rearing practices.

4.3.4 Year of experience

Findings on the years of experience in dairy goat farming is shown in Table 4.4

Table 4.4: Years of experience in dairy goat farming

Year of experience	Frequency	Percentage
0-2	97	60.6
3-5	47	29.4
6-8	12	7.5
over 9	4	2.5
Total	162	100.0

The respondents were asked to state the years of experience in dairy goat farming. The response tabulated above show that majority of the respondents (60.6%) had 0-2 years of experience in dairy goat farming, 29.4% had 3-5 years of experience in dairy goat farming, and 7.5% had 6-8 years of experience in dairy goat farming while 2.5% of the respondents had over 9 years of experience in dairy goat farming. This implies that most of the respondents had very little experience in dairy goat farming owing to the few years in the venture.

4.3.5 House hold size

Table 4.5 shows the size of respondents Households.

Table 4.5: Size of Households

House hold size	Frequency	Percentage
1-3	12	7.4
4-6	42	25.9
7-9	73	45.1
10-12	28	17.3
13 and above	7	4.3
Total	162	100.0

On the size of household, 45.1% of the respondents had a household of between 7-9 members, 25.9% had a household of between 4-6 members, 17.3% had a household of between 10-12 members, and 7.4% had a household of between 1-3 members while 4.3% of the respondents reported that they had a household of 13 members and above. This points to the fact that most families could be producing milk for local family consumption owing to their household numbers.

4.3.6 Occupation of the Respondents

Data on the occupation of the respondents is shown in Table 4.6

Table 4.6: Occupation of the respondents

Occupation	Frequency	Percentage
Farming only	143	88.3
Salaried employment	7	4.3
Occasional work	12	7.4
Total	162	100.0

The study also sought to establish the occupation of the respondents. From the findings, 88.3% of the respondents practiced farming only, 7.4% got occasional work while 4.3% of the respondents had salaried employment. This shows that most of the respondents practiced farming only and so had no alternative source of income.

4.4 Production information

The respondents were also required to indicate the size of their flock. From the study majority of the respondents had an average of one male, two females and two kids.

4.4.1 Breeds of goats kept

Information on the breeds kept by the farmers is shown by Table 4.7

Table 4.7: Breeds of goats kept

Breeds	Frequency	Percentage
Local	46	28.4
Alpine	86	53.1
Toggenburg	30	18.5
Total	162	100.0

The respondents were asked the type of breeds they kept. From the study findings, 53.1% of the respondents kept Alpine, 28.4% kept local breeds while 18.5% of the respondents kept Toggenburg breed. This shows that most of the people in Laikipia East district kept Alpine breed of goat.

4.4.2 Number of goats in lactation

Data on the number of goats in the lactation is shown in Table 4.8

Table 4.8: Number of goats in lactation

No of goats in lactation	Frequency	Percentage
None	71	43.8
1-2	80	49.4
3-4	8	4.9
> 5-6	3	1.9
Total	162	100.0

The respondents were also requested to indicate the number of goats in the lactation. From the results of the study, the majority of the respondents (49.4%) reported that their locations had 1-2 goats, 43.8% said that their locations did not have any goat, 4.9% said that their locations had 3-4 goats while 1.9% said that their locations had more than 5 goats. This shows that many respondents did not have a goat in lactation.

4.4.3 Average milk production per day

Data on the average production per doe per day in litres is shown in the Table 4.9

Table 4.9: Average milk production per doe per day in litres

Average production/day	Frequency	Percentage
<1	87	54.0
1-2	62	38.5
2-3	12	7.5
Total	161	100.0

The study also wanted to establish the average production per doe per day in liters. From the study findings, 54% of the respondents their doe produced less than one litre per day, 38.5% said they produced 1-2 litres while 7.5% said they produced 2-3 litres per day. This shows that in most cases the doe did not produce more than a litre of milk.

4.4.4 Average lactation length in dairy goats

Data on the average lactation length in months is shown in Table 4.10

Table 4.10: Average lactation length in months

Average lactation length	Frequency	Percentage
< 3	63	39.9
3-5	44	27.8
5-6	21	13.3
> 6	30	19.0
Total	158	100.0

The study also required the respondents to indicate the average lactation length in months. According to the responses given, 39.9% of the respondents reported that it was less than three months, 27.8% said it was 3-5 months, 19% said it was more than 6 months while 13.3% of the respondents said that it was between 5-6 months. This point to the fact that the average lactation length was less than three months. Further, the respondents indicated that the goats take an average of 11 months between one kidding and the other.

4.4.5 Reason for dairy goat farming

Data presented in Table 4.11 is on factors that drew the respondents to dairy goat farming

Table 4.11: Factors that drew the respondents to dairy goat farming

Reason for dairy goat	Frequency	Percentage
Milk for household	95	58.6
Money	50	30.9
Others	17	10.5
Total	162	100.0

The study also wanted to establish the factors that drew the respondents to dairy goat farming. According to the study, 58.6% of the respondents reported that they were drawn by milk for household, 30.9% said it was money while 10.5% said it was manure. This depicts the fact that most of the respondents kept the goats for household milk supply.

4.4.6 Milk use 6

Data on the use that the respondent put to the milk is presented in Table 4.12

Table 4.12: Use of goats milk by respondents

Milk use	Frequency	Percentage
Household consumption	133	82.1
Sale to neighbors	21	13.0
Giving to neighbors	3	1.9
Sale to market	5	3.1
Total	162	100.0

From the results of the study, the majority of respondents as shown by 82.1% used their milk for household consumption, 13% sell to neighbors, 3.1% sell to market while 1.9% give to neighbors. This confirms that the goats are kept mainly for domestic milk supply.

4.4.7 Type of Records

Data on the kind of records kept by the respondents is presented in Table 4.13

Table 4.13: Kind of records kept by the respondents

Type of Records	Frequency	Percentage
None	30	18.6
Birth weight	59	36.6
Health	32	19.9
Service age at first mating	19	11.8
Weaning weight	7	4.3
Identification	14	8.7
Total	161	100.0

On the kind of records kept by the respondents, the study established that most of the respondents (36.6%) kept records on birth weight, 19.9% kept health records, 18.6% kept no records at all, 11.8% kept records on service age at first mating, 8.7% kept identification records while 4.3% of the respondents kept weaning weight records. This shows that most of the people kept records on birth weight.

4.5 Management practices

This section describes the management practices adopted by the respondents

4.5.1 Means of skills Acquisition

Table 4.14 below represents data on how the respondent acquired skills in goat management

Table 4.14: Means of Acquisition of skills in goat management

Means of skills Acquisition	Frequency	Percentage
Shows	29	17.9
Tours	12	7.4
Media	3	1.9
Seminars/ workshops	95	58.6
Neighbors	20	12.3
Relatives	3	1.9
Total	162	100.0

According to the findings in the above Table 4.14, majority of respondents (58.6%) reported that they acquired skills in goat management from seminars/workshops, 17.9% said it was from shows, 12.3% said it was from neighbors, 7.4% said it was from tours while those who acquired skills in goat management from media and relatives were represented by a 1.9 each. This shows that most people acquired skills in goat management from seminars/workshops and trade shows.

4.5.2 Whether the respondents practice various activities

Data on whether the respondents practice various activities is shown in Table 4.15

Table 4.15: Practice of various management activities by farmers

	Always	Sometimes	Never	Mean	Std. Deviation
House both mother and kid in a dry, well-ventilated and secure house.	85.1	11.8	3.1	1.1801	.45946
Feed and water are placed on the outside of the house	73.9	18.6	7.5	1.3354	.61180
Feed and water troughs are raised from the floor	80.1	16.8	3.1	1.2298	.49052
Offer supplementary feeding	52.5	36.4	11.1	1.5864	.68384
The floor should be slatted to allow for free fall of droppings	69.8	19.1	11.1	1.4136	.68384
Clean feed and water provided all the time	71	22.8	6.2	1.3519	.59472
Mineral lick is provided	70.4	24.1	5.6	1.3519	.58418
Conservation of fodder for dry season	59.9	30.2	9.9	1.5000	.67105
Ensure the newborn kid suckles immediately after birth.	65.4	20.4	13.6	1.6049	1.76705
Disinfect umbilical cord immediately after birth	58.6	23.5	17.9	1.5926	.77664
Clean udder before milking	65.4	26.5	8	1.4259	.63837
Castration	50.9	28.6	20.5	1.6957	.79091
Hoof trimming	61.9	25.2	12.9	1.5097	.71503

Mean= weighted mean

On the question as to whether the respondents practice various activities, majority of the respondents reported that they always house both mother and kid in a dry, well-ventilated and secure house as shown by a mean score of 1.1801, feed and water troughs are raised from the

floor as shown by a mean score of 1.2298, feed and water are placed on the outside of the house as shown by a mean score of 1.3354, clean feed and water provided all the time and mineral lick is provided as shown by a mean score of 1.3519 in each case, the floor should be slatted to allow for free fall of droppings as shown by a mean score of 1.4136 and clean udder before milking as shown by a mean score of 1.4259.

The respondents also indicated that sometimes, there is conservation of fodder for dry season as shown by a mean score of 1.5000, there is hoof trimming as shown by a mean score of 1.5097, offer supplementary feeding as shown by a mean score of 1.5864, disinfect umbilical cord immediately after birth as shown by a mean score of 1.5926, ensure the newborn kid suckles immediately after birth as shown by a mean score of 1.6049 and castration is practiced as shown by a mean score of 1.6957. This depicts that always house both mother and kid in a dry, well-ventilated and secure house, feed and water troughs are raised from the floor, feed and water are placed on the outside of the house, feed and water provided all the time and mineral lick is provided.

4.6 Level of Adoption of Breeding Technology

This section describes the methods of breeding, breeding level, availability and level of awareness and opinions of the Artificial Insemination technology.

4.6.1 Breeding method

Table 4.16 below shows the breeding method adopted for the goats

Table 4.16: Breeding method adopted for the goats

Breeding method	Frequency	Percentage
Natural mating	153	94.4
A.I	9	5.6
Total	162	100.0

The study also inquired on the breeding method adopted for the goat. From the study, a majority 94.4% of the respondents said that they adopted natural mating in breeding the goats while a partly 5.6% said they adopted A.I. This shows that most of the farmers adopted natural mating in

breeding the goats. The respondents also said that the age of the doe at first mating is approximately one and a half year. This shows that the bucks were owned by groups.

4.6.2 Pay for service

Data on whether the respondents pay for the service is presented in Table 4.17

Table 4.17: Whether the respondents pay for the service

Pay for service	Frequency	Percentage
Yes	126	79.2
No	33	20.8
Total	159	100.0

On whether the respondents pay for the service, 79.2% of the respondents said that they pay for the service while 20.8% reported that they did not. This shows that since the bucks were owned by groups the respondents pay for the service. This was mainly for maintenance.

4.6.3 Comparison of milk production

Table 4.18 shows how milk production of the mother compared with that of the offspring

Table 4.18: How milk production of the mother compare with that of the offspring

Comparison of milk production	Frequency	Percentage
More	43	26.5
Less	119	73.4
Total	162	100.0

The study wanted to establish how milk production of the mother compares with that of the offspring. From the study findings, 73.4% of the respondents indicated that milk production of the mother is less than that of the offspring while 26.5% said it is more. This depicts that milk production increases from one generation to another.

4.6.4 Buck rotation time

Data on the duration that the buck remained in the group is represented in Table 4.19.

Table 4.19: Duration that the buck remained in the group

Back rotation time.	Frequency	Percentage
<2yrs	128	79.5
2-3yrs	30	18.6
>.3yrs	3	1.9
Total	162	100.0

On the duration that the buck whether self or group remain in the flock/ group, 79.5% of the respondents indicated that the buck whether self or group remain in the flock/ group for less than 2years, 18.6% said it remained for 2-3years while 1.9% said it remained for more than three years. This shows that the buck rotation time was less than 2years.

4.6.5 Breeding stage of goats

Table 4.20 below shows the stage of breeding that the respondent's goats are

Table 4.20: Stage of breeding of respondent's goats .

Breeding stage of goats	Frequency	Percentage
Foundation	53	32.7
intermediate	29	17.9
Apex	59	36.4
Pedigree	21	13.0
Total	162	100.0

The study also wanted to establish stage of breeding that the respondents' goats are. From the study findings, 36.4% of the respondents indicated that their goats are in the apex stage of breeding, 32.7% said that their goats are in the foundation stage of breeding, 17.9% said they were in the intermediate stage of breeding and only a partly 13% had their goats in the pedigree stage of breeding. This indicated that of the four stages, majority were at the apex and foundation stages. This indicated a slow rate of adoption since 2005. Majority of the respondents said that they had not encountered any abortions in their herd. They also added that around two does in their flock have been mated in the last one year out of which an approximate of one or two kids had been born out of the mated does.

4.6.6 Awareness of Artificial Insemination Technology

Table 4.21 shows data on whether the respondents are aware of Artificial Insemination technology

Table 4.21: Whether the respondents are aware of Artificial Insemination technology

Awareness of Artificial Insemination Technology	Frequency	Percentage
Yes	81	50.0
No	81	50.0
Total	162	100.0

From the results in the above table, there were an equal number of respondents who were aware and those who were not aware of Artificial Insemination technology.

4.6.7 Availability of Artificial Insemination

Data presented in Table 4.22 shows whether artificial insemination technology is available in the area

Table 4.22: Whether Artificial Insemination technology was available in the area

Availability of Artificial Insemination Technology	Frequency	Percentage
Yes	46	28.4
No	116	71.6
Total	162	100.0

The respondents were therefore requested to state whether Artificial Insemination technology is available in the area. From the study, 71.6% of the respondents reported that Artificial Insemination technology is not available in the area while 28.4% of the respondents reported that Artificial Insemination technology is available in their area. This shows that Artificial Insemination technology is not available in most of the areas.

The respondents were further requested to indicate their opinions of artificial insemination in goats on which they intimated that the goat produced more milk and meat, goat has less work, management of buck can be cheaper, reduce transmission of diseases, can ease the cost of keeping buck for better breeds, there is provision of semen of choice, enhance upgrading, increase the value of stock and services are easily available.

4.7 Disease and Pest control.

This section gives an analysis of data on disease and pest control.

4.7.1 Disease encounter in flock

Data on whether the respondents had encountered any diseases in their flock for the last one year is represented in Table 4.23

Table 4.23: Disease encounter in their flock for the last one year

Disease encounter in flock	Frequency	Percent
Yes	85	52.5
No	77	47.5
Total	162	100.0

The respondents were also required to indicate whether the respondents had encountered any diseases in their flock for the last one year. From the study, 52.5% of the respondents reported that they had encountered diseases in their flock for the last one year while 47.5% reported that they had not encountered any diseases in their flock for the last one year. This implies that most

farmers had encountered diseases in their flock for the last one year. The diseases include Diarrhoea, eye infection, pneumonia, bloat, mastitis, fever and malphalgia.

4.7.2 Vaccination of flock

Data on whether the flock has been vaccinated for the last one year is shown in Table 4.24

Table 4.24: Whether the flock has been vaccinated for the last one year

Vaccination of flock	Frequency	Percentage
Yes	65	40.1
No	97	59.9
Total	162	100.0

The research also wanted to establish whether the flock has been vaccinated for the last one year. From the study findings, 59.9% of the flocks had not been vaccinated for the last one year while only 40.1% of the flocks had been vaccinated for the last one year against Contagious Caprine Pleural Pneumonia.

4.7.3 Reason for not vaccinating

Data in Table 4.25 shows the reason for the flock not being vaccinated for the last one year

Table 4.25: Reason for the flock not being vaccinated for the last one year

Reason for not vaccinating	Frequency	Percentage
Vaccine not available	31	19.1
Vaccine not affordable	38	23.5
Not aware of vaccination schedule	49	30.2
Not aware on need to vaccinate	44	27.2
Total	162	100.0

According to the findings in the above table, most of the respondents (30.2%) reported that the reason for the flock not being vaccinated for the last one year is that they are not aware of vaccination schedule, 27.2% said it is because they were not aware on need to vaccination, 23.5% said that the vaccine were not affordable while 19.1% said that the vaccine was not

available. This depicts the fact that the major reason for the flock not being vaccinated for the last one year is that the farmers are not aware of vaccination schedule.

4.7.4 Goat loss

Data on whether the respondents have lost any goat within the last one year is shown in Table 4.26

Table 4.26: Whether the respondents have lost any goat within the last one year

Goat loss	Frequency	Percentage
Yes	55	34.0
No	107	66.0
Total	162	100.0

The study also sought to establish the whether the respondents have lost any goat within the last one year. From the study, the majority of respondents as shown by 66% said have not lost a goat within the last one year while 34% said they have. This shows that there are not very many cases of death in the flock.

4.7.5 Cause of loss

Table 4.27 shows the cause of loss of the goats

Table 4.27: Cause of loss for the goats

Cause of loss	Frequency	Percentage
Disease	62	38.3
Injury	40	24.7
Predator	30	18.5
Theft	28	17.3
Other	2	1.2
Total	162	100.0

The research also wanted to establish the cause of death for the goats. From the study findings, 38.3% of the death for the goats had been caused by disease, 24.7% of the cases were caused by injury, 18.5% were caused by predators, 17.3% were caused by theft while 1.2% of the cases were caused by other causes. This shows that diseases remain the main cause of death among goats.

4.8.1 Awareness of threat of worms and ticks to goat health.

Data on Table 4.28 shows whether the respondents are aware worms and ticks pose a great threat to the health of goats

Table 4.28: Awareness of worms and ticks as threat to the health of goats

Awareness	Frequency	Percentage
Yes	150	92.6
No	12	7.4
Total	162	100.0

On whether the respondents are aware worms and ticks pose a great threat to the health of goats, majority of the respondents (92.6%) said they are aware worms and ticks pose a great threat to the health of goats while 7.4% are not aware. This shows that the farmers are aware worms and ticks pose a great threat to the health of goats.

4.8.2 Acquisition of control products

Data in Table 4.29 shows how the respondents acquire pest control products

Table 4.29: How the respondents acquire pest control products

Acquisition of control products	Frequency	Percentage
Individual procurement	123	75.9
Group procures for members	36	22.2
Government provision	3	1.9
Total	162	100.0

The respondents were asked to state how they acquire pest control products. From the study findings, majority of the respondents (75.9%) reported that they acquire pest control products through individual procuring, 22.2% reported that the group procures for members while 1.9% of the respondents indicated that it was through government provision. This shows that in most cases, the farmers acquire pest control products through individual procurement.

4.8.2 Frequency of worm control

Table 4.30 shows the frequency of worm control

Table 4.30: Frequency of worm control

	Frequency	Percentage
<3 months	34	21.0
3 months	93	57.4
>3 months	35	21.6
	162	100.0

The research also wanted to establish the frequency of worm control. From the study findings, 57.4% of the respondents indicated that they do worm control after three months, 21.6% said they do it in more than three months while 21% said they do it in less than three months.

4.8.3 Frequency of tick control

Data on the frequency of tick control is shown in Table 4.31

Table 4.31: Frequency of tick control

Frequency of tick control	Frequency	Percentage
< one week	4	2.5
One week	105	64.8
> one week	53	32.7
Total	162	100.0

The respondents further indicated that they undertake tick control after one week as shown by 64.8%, 32.7% said more than one week while 2.5% said they do it after less than one week.

While the greater majority practiced the right worm control (every 3 months) and right tick control (weekly) the ones who had a longer interval attributed this to unaffordability and did not have a control program. They only undertook the activity only when offered free of charge either by government or any other agent

4.9 Marketing of Goat Products

This section describes market access for goats and their products.

4.9.1 Information on where to sell their goats and their products

Table 4.32 below shows data on whether the respondents have information on where to sell their goats/ products

Table 4.32: Whether the respondents had information on where to sell their goats/ products

	Frequency	Percentage
Yes	64	39.5
No	98	60.5
Total	162	100.0

The respondents were also requested to indicate whether they have information on where to sell their goats/ products. According to the findings, 60.5% of the respondents did not have information on where to sell their goats/ products while 39.5% had information on where to sell their goats/ products. This shows that the farmers don't have information on where to sell their goats/ products.

The respondents were also required to indicate how they determined the value of their goats when selling. From the study the respondents confided that they determined the value of their goats when selling using the breeding level and grading, asking from other farmers, by DGAK, by stage and status of the goat, by goat's size and milk production. From the findings, the farmers had not sold milk, kids or culls in the last one year.

4.9.2 Distance to market

Table 4.33 shows the distance to the market

Table 4.33: Distance to the market

Distance to market	Frequency	Percentage
Farm gate	99	61.1
< 1km	20	12.3
1-3km	36	22.2
4-6km	3	1.9
>6km	4	2.5
Total	162	100.0

The respondents were asked the distance to the market. From the study findings, 61.1% of the farmers had the market at their farm gate, 22.2% said the market was 1-3km, 12.3% said it was less than 1km, 2.5% said that it was more than 6km while 1.9% of the respondents said it was 4-6km away. This shows that the market was just near to the farmers.

4.9.3 Market outlets for respondents' milk

Table 4.34 data on the people that buy the respondents milk

Table 4.34: People that buy the respondents milk

	Frequency	Percentage
Neighbors	25	15.4
Milk bars	5	3.1
Friends	1	.6
Don't sell	131	80.9
Total	162	100.0

The respondents were also requested to indicate the people that buy their milk. From the results of the study, the majority of the respondents (80.9%) reported that they don't sell their milk,

15.4% said that they sell to neighbors, 3.1% said they sell to milk bars while 0.6% of the respondents said they sold their milk to friends. This point to the fact that most of the farmers don't sell their milk

4.9.4 Membership to marketing group or common interest group

Table 4.35 shows data on whether the respondents belong to a marketing group or common interest group

Table 4.35: Membership to a marketing group or common interest group

	Frequency	Percentage
Yes	98	60.5
No	64	39.5
Total	162	100.0

According to the findings in the above table, the majority of respondents (60.5%) reported that they belong to a marketing group or common interest group while 39.5% of the respondents did not belong to a marketing group or common interest group. This shows that most farmers belong to a marketing group or common interest group. They also indicated that the role of the group were to helps in bringing buyers, helps in deworming, training on how to rear goats and sheep and help in market search. The farmers also indicated that the challenges of raising dairy goats in Laikipia East District include the fact that climate in the area is unpredictable, prolonged length before kidding, lack of hay harvesting equipments, low level of breeds, drought, diseases, feeds scarcity, artificial insemination is unavailable thus reducing the production and lack milk market.

4.10 Summary of Findings of Focus Group Discussion

The researcher held a focus group discussion with extension staff from the ministry of livestock. These were drawn from Veterinary and Livestock Production departments. The main purpose was for triangulation of the information obtained from the respondents of the dairy goat farmers.

The extension staff intimated that there were on average 2 goats per homestead mostly local and alpine and the average milk production was about 0.5 litres per day. Further, the management practices undertaken by dairy goat farmers in Laikipia East District included deworming, pest

and tick control, diseases management, hoof trimming and checking herd health. However the farmers were faced with management challenges such as lack of extension services and poor feeding. Farmers acquired the management skills mostly through workshops and seminars, from extension officers and through experience.

The breeding methods adopted by the farmers according to the interviewees included natural mating, controlled, specific buck, free mating and only a few had a breeding programme. Farmers sourced breeding bucks from organized groups such as DGAK. Buck rotation time was mostly after 15 months but others 2 years. The average kidding interval according to the officers was 9 months to 12 months. The interviewees were in agreement that artificial insemination service was available in the district, though it had not peaked and only very few farmers had adopted. This was mostly due to the cost which was relatively high while others had a wait and see attitude.

According to the extension officers, the major diseases that afflict goats in the district include Contagious Caprine Pleura Pneumonia, heart water. They also intimated that there was a routine vaccination programme in the District. The vaccination turnouts were about 50% and the vaccines were not readily available.

The interviewees also intimated that the farmers did not have access to market information and they sold their products mostly locally at ksh 40- 80 per litre, kids at ksh. 3,000 each, cream at ksh. 280 per kg. The markets distance was diverse depending on the locality and farmers were distributed throughout the district. On whether there were organized formal or informal market groups and what role they played, the interviewees were not aware of any such groups. The extension officers interacted with the dairy goat farmers and offered extension services that were demand driven but mainly vaccinations and training. The officers also indicated that the major constraints to the dairy goat sector in Laikipia East District include lack of organized groups to market farmers' products, breeding methods may cause inbreeding, lack of vaccines and drought from time to time hence lack of feeds.

4.11 Extent that various Factors Influence Productivity of Dairy Goats

In addition, the researcher conducted a multiple regression analysis so as to test relationship among variables (independent). The researcher applied the statistical package for social sciences (SPSS) to code, enter and compute the measurements of the multiple regressions for the study.

4.11.1 Model Summary

Table 4.36 shows the Model Summary

Table 4.36: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.849	0.7208	.719	.65323

Coefficient of determination explains the extent to which changes in the dependent variable can be explained by the change in the independent variables or the percentage of variation in the dependent variable (productivity of dairy goats) that is explained by all the four independent variables (dairy goat management, breeding programme, market access and diseases and pests).

The four independent variables that were studied, explain only 72.07% of the productivity of dairy goats among small scale farmers in Laikipia East District as represented by the R^2 . This therefore means that other factors not studied in this research contribute 27.93% of the productivity of dairy goats. Therefore, further research should be conducted to investigate the other factors (27.93%) that influence the productivity of dairy goats.

4.11.2 ANOVA results

Data on ANOVA is shown in Table 4.37

Table 4.37: ANOVA

Model	Sum of Squares	Df	Mean Square	F	Sig.
1 Regression	2.257	2	1.215	4.423	.0215
Residual	9.321	27	2.335		
Total	3.578	29			

The significance value is .0215 which is less than 0.05 thus the model is statistically significant in predicting how dairy goat management, breeding programme, market access and diseases and pests affect the productivity of dairy goats among small scale farmers in Laikipia East District. The F critical at 5% level of significance was 2.93. Since F calculated is greater than the F critical (value = 4.423), this shows that the overall model was significant.

4.11.3 Coefficient of Determination

Table 4.38 shows the coefficient of determination

Table 4.38: Coefficient of determination

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	1.325	1.563		4.945	.367
Dairy goat management	.613	.143	.157	5.093	.0188
Breeding programme	.489	.115	.087	4.949	.0267
Market Access	.292	.221	.155	3.527	.0458
Diseases and pests	.325	.293	.512	4.276	.0334

The researcher conducted a multiple regression analysis so as to determine the relationship between productivity of dairy goats and the four variables. As per the SPSS generated table 4.38, the equation ($Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \epsilon$) becomes:

$$Y = 1.325 + 0.613X_1 + 0.489X_2 + 0.292X_3 + 0.325X_4$$

According to the regression equation established, taking all factors into account (dairy goat management, breeding programme, market access and diseases and pests) constant at zero, the productivity of dairy goats among small scale farmers in Laikipia East District will be 1.325. The data findings analyzed also shows that taking all other independent variables at zero, a unit increase in dairy goat management will lead to a 0.613 increase in productivity of dairy goats. A unit increase in breeding programme will lead to a 0.489 increase in productivity of dairy goats; a unit increase in market access will lead to a 0.292 increase in productivity of dairy goats and a unit increase in diseases and pests will lead to a 0.325 increase in on productivity of dairy goats. This infers that dairy goat management contributes more to the productivity of dairy goats followed by breeding programme.

At 5% level of significance and 95% level of confidence, dairy goat management had a 0.0188 level of significance; breeding programme had a 0.0267 level of significance, market access showed a 0.0458 level of significant and diseases and pests showed a 0.0334 level of significance hence the most significant factor is dairy goat management. The t critical at 5% level of significance at $k = 4$ degrees of freedom is 2.423. Since all t calculated values were above 2.423 then all the variables were significant in explaining the performance.

CHAPTER FIVE

SUMMARY OF FINDINGS, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presented the summary of findings, discussion and conclusion drawn from the findings and recommendation made. The conclusions and recommendations drawn focus on the purpose of the study which was to establish the factors influencing productivity of dairy goats among small scale farmers in Laikipia East District. The study failed to control for but recognized that the existing government policy could also influence the productivity of dairy goats either directly or indirectly. Recommendations are made for the policy makers, farmers, researchers and other stakeholders.

5.2 Summary of major Findings

The study came up with the following major findings.

1. The majority of the respondents were females (61.7%). The study found that majority (66.3%) of the respondents were over 49 years of age while the youth (18-38) comprised only 10.6%. Majority of the respondents (50%) had only primary school level of education and 60% of the respondents had less than 2years experience in dairy goat farming. The average household size was 7 and 88.3% of the respondents earned their livelihood from farming only.
2. Most farmers had an average of one male, two females and two kids. It was also established that most of the people in Laikipia East district kept Alpine breed of goat with a few keeping the Toggenberg breed. These were mainly crosses that were being upgraded from the local goats. In most cases the doe did not produce more than a litre of milk and the average lactation length was less than three months. Further, most of the respondents kept the goats for household milk supply and kept records mostly on birth weight. Majority had less than two years of experience in dairy goat farming.

3. On management practices, the study revealed that most people acquired skills in goat management from seminars/workshops and trade shows. Majority of the farmers always housed both mother and kid in a dry, well-ventilated and secure house, feed and water are provided all the time, toughs are raised from the floor and placed on the outside of the house. Mineral lick was provided, the floor was slated to allow for free fall of droppings and that they always cleaned the udder before milking.
4. On the level of adoption of breeding technology, the study deduced that most of the farmers adopted natural mating in breeding the goats. It was clear that the bucks were owned by groups and the age of the doe at first mating is approximately one and a half year. Further since the bucks were owned by groups the respondents paid for the service. The study also established that milk production increased from one generation to another and that the buck remained in the group for less than 2years.
5. Most of the goats in the district were in the apex stage of breeding. Most respondents had also not encountered any abortions in their herd. Around two does in their flock had been mated in the last one year out of which an approximate of one or two kids had been born out of the mated does. It was clear that Artificial Insemination technology was not available in most of the areas. The farmers felt that after artificial insemination, the goat would produce more milk and meat, the buck would have less work, management of buck would be cheaper, it would reduce transmission of diseases, would ease the cost of keeping buck for better breeds, there would be provision of semen of choice, it would enhance upgrading, increase the value of stock and services would be easily available though cost could be prohibitive.
6. On disease control, the study deduced that most farmers had encountered diseases in their flock for the last one year. The diseases included Diarrhoea, eye infection, pneumonia, bloat, mastitis, fever, Contagious Caprine Pleura Pneumonia (CCPP), heart water, and malphalgia. Most of the flocks had not been vaccinated for the last one year. It was deduced that the major reason for the flock not being vaccinated for the last one year was that the farmers were not aware of vaccination schedule .vaccination turnout was low (50%). 34% of the respondents had lost a goat in the last one year and diseases remained the main cause of death among goats.

7. On parasite control, the study deduced that the farmers are aware worms and ticks posed a great threat to the health of goats. The study also established that in most cases, the farmers acquired pest control products through individual procurement and undertook worm control every 3 months and tick control on weekly basis. However there was still a large population that undertook the activities only when the pest and worm control agents were available and so did not have a consistent program.
8. On marketing of goat products, the study revealed that the farmers did not have information on where to sell their goats/ products. They determined the value of their goats when selling using the breeding level and grading, asking from other farmers, by DGAK, by stage and status of the goat, by goat's size and milk production. Most of the farmers in the district had not sold milk, kids or culls in the last one year though the market was just near to the farmers. It was clear that most farmers belonged to a marketing group or common interest group. The roles of the group were to help in bringing buyers, deworming, and training on how to rear goats and sheep and help in market search.
9. The challenges of raising dairy goats in Laikipia East District include unpredictable weather with frequent drought, prolonged length before kidding, lack of hay harvesting equipments, low level of breeds, diseases, feeds scarcity, availability and affordability of artificial insemination services thus reducing the production and lack milk market with most sales at farm gate.

5.3 Discussion of the Study Findings

Productivity when applied to livestock refers to either level of production or efficiency of production (James and Carles, 1996). In any production system, productivity will be uniquely influenced by complex interactions of environmental, biological and socioeconomic variables (Omore, 1998). The variables are interrelated and, therefore, should be looked at holistically to determine their relative importance and how changes in each affected the whole system. Multiple regression analysis was used to test the relationship among the variables. The study deduced that the four independent variables that were studied, explain only 72.07% of the productivity of dairy goats among small scale farmers in Laikipia East District as represented by the R^2 . This therefore means that other factors not studied in this research contribute 27.93% of the

productivity of dairy goats. Therefore, further research should be conducted to investigate the other factors (27.93%) that influence the productivity of dairy goats.

The data findings analyzed also showed that taking all other independent variables at zero, a unit increase in dairy goat management will lead to a 0.613 increase in productivity of dairy goats. A unit increase in breeding programme will lead to a 0.489 increase in productivity of dairy goats; a unit increase in market access will lead to a 0.292 increase in productivity of dairy goats and a unit increase in diseases and pests will lead to a 0.325 increase in on productivity of dairy goats. This infers that dairy goat management contributes more to the productivity of dairy goats followed by breeding programme.

Options for increasing livestock productivity include improvements in nutrition, disease control, management and breeding (Upton 2000). The farmer cannot, for example concentrate on feeding alone and hope to have a 'good' herd, but should combine good nutrition with disease control, breeding and management such as housing, cleaning, clean milk production and record keeping. This is in line with the findings of the study where all the four factors were found to have a contributory effect to productivity and need to be improved as a package.

On management practices, the study revealed that most farmers practiced the right management practices, however productivity still remained low. This therefore meant that the quality of the management was poor. Record keeping was very poor with farmers focusing more on birth weights. Majority rarely recorded the volume of milk produced as it was perceived to be too low (less than 1litre)

The farmers ventured into dairy goat farming with the objective of producing milk for their households and also as make money from the enterprise. This concurs with the findings of Dubeuf (2003) that the main use of milk is house hold, sale to neighbourhood and kid suckling.

The study found that most farmers had an average of one male, two females and two kids. It was also established that most of the people in Laikipia East district kept Alpine breed of goat. In most cases the doe did not produce more than a litre of milk and the average lactation length was less than three months. In line with this, Davendra and Burns (1983) indicated that the Kenyan goat performances in terms of growth rate and milk yield are very low. The question of how

efficient goats as milk producers depends on how capable they are to produce milk in excess of kids' requirements.

On the level of adoption of breeding technology, the study deduced that most of the farmers adopted natural mating in breeding the goats. Most of the goats were at the foundation and intermediate stage (50.3%) and this could explain the low milk production. The study also established that milk production increased from one generation to another and that the buck remained in the group for less than 2 years.

It was clear that Artificial Insemination technology was not available in most of the areas. The farmers who had adopted A.I reported that after artificial insemination, the goat produced more milk and meat, there was reduced transmission of diseases, eased the cost of keeping buck for better breeds, there was provision of semen of choice, enhanced upgrading, increased the value of stock . These findings are consistent with those by Heinlein, Caccese and Smith (2011) that Artificial Insemination(AI) has some key advantages over natural breeding in that it eliminates the necessity of keeping one or several bucks on the farm (depending on herd size). Costs of feeding, housing, separate fencing and labor are eliminated; AI can increase the rate of genetic improvement in the herd, as long as superior bucks are consistently selected; the danger of transmission of diseases or parasites is greatly reduced and AI induces good recordkeeping of dates of heat, breeding, pedigrees, etc. This will aid in herd improvements and enable the owner to make better culling decisions.

Mugerwa (1996) observed that diseases significantly reduce productivity irrespective of the ecological zone. On disease control, the study deduced that most farmers had encountered diseases in their flock for the last one year. The diseases included Diarrhoea, eye infection, pneumonia, bloat, mastitis, fever, Contagious Caprine Pleura Pneumonia (CCPP), heart water, and malphalgia. Most of the flocks had not been vaccinated for the last one year. It was deduced that the major reason for the flock not being vaccinated for the last one year is that the farmers are not aware of vaccination schedule. 34% of the farmers had lost a goat in the last one year. However diseases remain the main cause of death among goats. Mugerwa (1996) observed that Contagious Caprine Pleural Pneumonia (CCPP) and Peste des Petite Ruminants (PPR) are widely distributed diseases which unless properly controlled, can limit animal production over

wide areas. De Haan and Bekure 1991) also observed that diseases have direct losses including mortality and morbidity.

On parasite control, the study deduced that the farmers were aware worms and ticks posed a great threat to the health of goats. The study also established that in most cases, the farmers acquired pest control products through individual procurement and undertook worm control after 3 months and tick control after 1 week. These findings are similar to those by Franz and Nguyen (1997) parasites, both internal and external are the most important health concerns for goat health and productivity.

On marketing of goat products, the study revealed that the farmers did not have information on where to sell their goats or products. The farmers determined the value of their goats when selling using the breeding level and grading, asking from other farmers, by DGAK, by stage and status of the goat, by goat's size and milk production. Most of the farmers in the district had not sold milk, kids or culls in the last one year though the market was just near to the farmers. It was clear that most farmers belonged to a marketing group or common interest group. The role of the group were to help in bringing buyers, help in deworming, training on how to rear goats and sheep and help in market search. Jabarl, et al (2005) observed that distance to market significantly reduces milk sold particularly in rural areas. Use of informal market channels also contributed to high output and sale in rural areas. House hold size significantly reduces the amount sold and also where house hold has more children below working age who do not contribute to farm labor but significantly increase household consumption. The study found that majority of the few farmers that sold milk (61%) the sales were made at farm gate. This concurs with the study by Omiti, Otieno and Nyanauba (2009) that demonstrated that that peri urban areas had a higher market orientation than rural villages who sell mainly at farm gate and rural markets and further market information plays a significant role in farmer's decision on how much output to put to the market depending on prevailing price and nearness to the market outlet.

The challenges of raising dairy goats in Laikipia East District include the fact that climate in the area is unpredictable, prolonged length before kidding, lack of hay harvesting equipments, low level of breeds, drought, diseases, feed scarcity, artificial insemination unavailable thus reducing

the production and lack milk market. These are similar to those identified by Ahuya et al, (2005) including management related issues such as inadequate husbandry, inadequate and ready supply of most appropriate type of breeding stock and how they can be improved, lack or poor supply of inputs, including drugs, feed, water, unavailability of appropriate markets, poor market organization, poor infrastructure and lack of efficient information networks, poor public policy on environment, poor administration of animal health policies , Frequent droughts and lack of preparedness of such calamities.

5.4 Conclusions of the Study

The following conclusions were made from the study findings.

The study concludes that all four independent variables that were studied, i.e. dairy goat management practices, level of adoption of breeding technology, disease and pest control and access to markets all influence productivity of dairy goats among small scale farmers in Laikipia East District. These however explain only 72.07% of the productivity. This therefore means that other factors not studied in this research contribute 27.93% of the productivity of dairy goats. Therefore, further research should be conducted to investigate the other factors (27.93%) that influence the productivity of dairy goats to enable the farmers to exploit the potential of dairy goat farming.

The study also concludes that all the variables were significant in explaining the performance and management practice was the most significant.

That dairy goat management contributes more to the productivity of dairy goats followed by breeding programme The study deduced that most farmers practiced the right management practices since technical knowledge was adequate but goat performance indicates otherwise. This could only mean that the quality of the practices is wanting and need to be improved. This requires constant monitoring of application of the knowledge to determine the constraints.

Study concludes death was the major cause of loss of goats and disease control programmes were inconsistent. Farmers did not have market information relied on the dairy goat association officials. Most of the farmers in the district had not sold milk, kids or culls in the last one year

though the market demand was high due to very low production of milk and they were trying to build up their herds. Those who sold milk did so at the farm gate.

Majority belonged to a marketing group or common interest group that helped in training on how to rear goats and sheep and help in market search. This can be an entry point for capacity building of the farmers.

Finally the study concludes that farmers were not meeting the objective of milk for household and income and that the potential for the dairy goats in Laikipia are highly underexploited.

5.5 Recommendations of the Study

From the study findings and conclusions, the following recommendations for policy makers, extension staff and other stakeholders.

1. Management practices, level of adoption of breeding technology, disease and pests and market access were all found to be interrelated and to influence productivity. There should be concerted effort to improve all of them for the dairy goat farmers to exploit their potential and reap the benefits of dairy goat farming.

- a) The farmers should be sensitized on the importance quality management practices, breeding, diseases and pest control and market orientation of dairy goat farming.
- b) To avert feed scarcity, conservation of fodder for dry season during the periods of plenty should be adopted and farmers should be assisted with hay harvesting equipment.

2. Record keeping should be emphasized to enable farmers to plan for the production and monitor performance.

3. There should be district wide sensitization on Artificial Insemination technology to enhance adoption and milk production and enhance upgrading and increase the value of stock.

4. Government disease control programmes should be consistent. Dairy goat groups should be encouraged to pool their resources to enable them procure the products in bulk which would be cheaper than the individual purchases.

5. A value chain approach is recommended for interventions with value chain mapping to identify capacity gaps.

6 Farmers should have access to market information as this provides incentives to adopt technological interventions to improve productivity. The study further recommends institutional and policy support to hence uptake of dairy goat technology.

7. Where farmers have received goats through various projects, monitoring and evaluation should be carried and corrective actions taken.

8. Where groups are organized, there should be exchange visits to the more progressive areas for lesson learning.

5.6 Areas of Further Research

Further research should consider investigating the following;

1. Further research should be conducted to investigate the other factors (27.93%) that influence the productivity of dairy goats
2. Factors influencing productivity of dairy goats among small scale farmers in other districts in Kenya to allow for generalization of the factors influencing productivity of dairy goats among small scale farmers in Kenya.
3. Study found that 60% had less than 2years experience in dairy goat farming yet the technology had been introduced way back in 2005. It is recommended that a study be undertaken to establish the factors that have influenced the slow rate of adoption.
4. Breeding bucks should be investigated to ascertain their quality to ascertain if they were indeed purebreds.

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APPENDICES

APPENDIX 1: TRANSMITTAL LETTER

Julia Wanjiru Kinyua
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To whom it may concern

Dear Sir/Madam

RE: QUESTIONNAIRE ON FACTORS INFLUENCING DAIRY GOAT FARMING IN LAIKIPIA COUNTY; A CASE OF LAIKIPIA EAST DISTRICT

I am a post graduate student of the University of Nairobi, pursuing a Master of Arts degree in Project Planning and Management. I am currently undertaking a study on the above subject as a partial fulfillment for the degree course.

I have selected you as a respondent in my research with the aim of getting your views on factors that influence productivity of dairy goat in Laikipia east District.

The information that you will provide will be for academic purposes only and will be treated confidentially.

Kindly respond to all the questions as honestly as possible and seek clarification where need arises.

Thank you for your cooperation.

Yours Faithfully



Julia Kinyua.

APPENDIX 2: QUESTIONNAIRE FOR HOUSE HOLD HEADS

Instructions; Kindly respond by putting a tick where applicable or filling blank spaces.

Section A Farmer Demographics

Date-----

1. Respondent name ----- location -----
2. Gender of respondent (tick) M [] F []
3. Age of respondent in years 18-28 [] 29- 38[] 39-48 [] 49-58[] .>59-----
4. Highest level of education of house hold head (tick)
[] None [] Primary [] Secondary [] Post Secondary
5. Years of experience in dairy goat farming (tick) 0-2 [] 3-5[] 6-8 [] over 9 []
6. What is the size of your House hold? -----
7. What is the estimated size of your land in acres? 1-3[] 4-6 [] 7-9 [] >10[]
8. Occupation of the respondents. Farming only [] Occasional work []
Salaried employment [] Petty trader []

Section B Production information

9. What is the size of your flock? M [] F [] Kids []
- 10 What breeds do you keep? Local [] alpine [] Toggenburg [] other [] Specify-----
11. How many goats are in lactation? None [] 1-2[] 3-4 [] > 5-6 []
12. What is the average production per doe per day? Lts. <1 [] 1-2 [] 2-3 [] >3l []
13. What is the average lactation length in months? <3 [] 3-5[] 5-6 [] >6 []
14. How long do your goats take between one kidding and the other? -----

15. What drew you to dairy goat farming? Milk for household [] Money [] Manure []
 Social status [] everyone was doing it []

16. What use do you put to the milk? House hold consumption [] Giving to neighbours []
 Sale to neighbours [] Sale to market []

17. What kind of records do you keep? None [] Birth weight [] Milk production []
 Health [] Service age at first mating [] Weaning weight [] Identification []

Section C Management practices

18. How did you acquire skills in goat management? Through; Shows [] Tours []
 Media [] Seminars/ workshops [] Neighbours [] Relatives []

19. Kindly indicate whether you practice the following

Statement of management	Always	Sometimes	Never
House both mother and kid in a dry, well-ventilated and secure house.			
Feed and water are placed on the outside of the house.			
Feed and water troughs are raised from the floor			
Offer supplementary feeding			
The floor should be slatted to allow for free fall of droppings			
Clean feed and water provided all the time			
Mineral lick is provided			
Conservation of fodder for dry season			
Ensure the newborn kid suckles immediately after birth.			
Disinfect umbilical cord immediately after birth			
Clean udder before milking			
Castration			
Hoof trimming			

Section D Level of adoption of breeding technology

20. What breeding method have you adopted for the goats? Natural mating [] A.I []
21. If natural mating, what is the source of the breeding buck? Own [] group [] other -----
----- [specify]
22. What is the age of the doe at first mating?
23. Do you pay for the service? Yes [] no [] if yes how much -----
24. How does milk production of the mother compare with that of the offspring? It is
More [] Less []
25. If buck is self or group, how long does it remain in the flock/ group?
<2yrs [] 2-3yrs [] >.3yrs []
26. At what stage of breeding are your goats?
Foundation [] intermediate [] Apex [] Pedigree []
27. Have you encountered any abortions in your herd?
28. How many does in your flock have been mated in the last one year? -----
29. How many kids have been born out of the mated does? -----
30. Are you aware of Artificial Insemination technology? Yes [] no [] if yes,
31. Is it available in your area? Yes [] No [] If yes what is the cost? -----
32. Kindly indicate your two opinions of artificial insemination in goats.

Section E Disease control

33. Have you encountered any diseases in your flock for the last one year? Yes [] No []

34. If yes, kindly list the diseases in order of importance

1 ----- 2 -----
3 ----- 4 -----

35. Has your flock been vaccinated for the last one year? Yes [] No []

36. If yes against which disease (s) did you vaccinate? -----

37. If no, kindly give reason (tick) Vaccine not available [] Vaccine not affordable []
Not aware of vaccination schedule [] Not aware on need to vaccinate []

38. Have you lost any goat within the last one year? Yes [] No []

39. If yes indicate cause of death; Disease [] Injury [] Predator [] Theft []
Other [] Specify-----

Section F Parasite control

40. Are you aware worms and ticks pose a great threat to the health of goats? Yes [] No []

41. How do you acquire pest control products? I procure [] Group procures for members []
Government provision [] other (specify) -----

42. Kindly indicate how often you undertake the following activities;

Worm control ----- tick control -----

Section G Marketing of goat products

43. Do you have information on where to sell your goats/ products? Yes [] No []

44. How do you determine the value of your goats when selling? -----

45. Have you sold any of these products in the last one year? Kindly indicate number and price.

Milk []	litres []	price per litre-----
	Number sold	price per animal
Kids [M]	[]	-----
[F]	[]	-----
Culls [M]	[]	-----

46. What is the distance to the market?

Farm gate [] < 1km [] 1-3km [] 4-6km [] >6km []

47. Who buys your milk? Neighbours [] Milk bars [] Processors [] Friends []

Other [] Specify -----

48. If you own a buck, do you charge for its services Yes [] how much ----- No []

49. Do you belong to a marketing group or common interest group? Yes [] No []

50. If yes, please indicate the role of the group

SECTION H Extension services

51. Kindly tick as appropriate.

Extension services are Accessible [] Inaccessible [] Affordable [] Not affordable []

52. Where extension Education was available, what was the subject area? Feeding []

Housing [] Disease and pest control [] Breeding [] Dairy goat farming as a business []

53. Who provides you with services? Government staff [] Private service providers []

NGO [] other (specify) -----

54. Kindly give two challenges of raising dairy goats in Laikipia East District.

THANK YOU FOR YOUR TIME.

APPENDIX 3: INTERVIEW GUIDE FOR EXTENSION STAFF

1. What are the average flock sizes? What goat breeds do farmers keep?
2. What is the average milk production?
3. What management practices are undertaken by dairy goat farmers in Laikipia East District?
4. What management challenges do dairy goat farmers experience?
5. How do the farmers acquire the management skills?
6. What breeding methods have been adopted by the farmers?
7. Do they have a breeding programme?
8. Where do they source breeding bucks from?
9. What is the buck rotation time?
10. What is the average kidding interval?
11. Is artificial insemination service available in the district? What is the cost?
12. What diseases afflict goats in the district?
13. Are there routine vaccination programmes in the District?
14. How are the vaccination turnouts? Is vaccine readily available?
15. Do farmers have access to market information?
16. Where do they sell their products? What are the average prices?
17. How far are the markets?
18. Are there organized formal or informal market groups and what role do they play?
19. How often do you interact with the dairy goat farmers and in which area do you offer extension services?
20. In your view what are the major constraints to the dairy goat sector in Laikipia East District?

THANK YOU

APPENDIX 4: LOCATION OF LAIKIPIA COUNTY ON THE MAP OF KENYA

