RELATIONSHIP BETWEEN LIVESTOCK DEVELOPMENT PROGRAMME AND DAIRY CATTLE PRODUCTION AMONG SMALL SCALE FARMERS IN HOMA BAY AND NDHIWA SUB-COUNTIES

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DECLARATION AND RECOMMENDATION

Declaration

I declare that this thesis is my original work and has not been presented by anybody else in this or any other university.

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DEDICATION

This thesis is dedicated to my husband Pamphil Mayabi, my children; Manfred Makhanga, Georginah Khati and Gregory Stower. Your love, concern and support contributed to successful compilation of this thesis. I could not have managed without you.

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ABSTRACT

Since independence Kenya has relied on the agriculture sector which includes livestock as a base for economic growth. Livestock Development Programme (LDP) was a Finnish programme that was initiated in Homa Bay and Ndhiwa sub-counties in 1991-2003 to address constraints in dairy cattle production. Its ultimate goal was to raise milk production and improve small scale dairy cattle farmers' levels of living. A study to determine the extent of relationship between the LDP programme's packages: upgrading of Zebu cows, fodder production and disease control may not have been done. The research determined the extent of relationship between the packages and dairy cattle production in the study area. The study adopted a descriptive and correlation design. Study locations were selected purposively because they implemented the programme. Target population was all dairy cattle farmers in Homa Bay and Ndhiwa sub-counties while accessible population was 1044 LDP dairy cattle farmers who implemented the programme. Sample size was 151 small scale dairy cattle farmers and 12 extension agents from Department of Livestock Production. Respondents were selected through proportionate then random sampling. Interview schedules and questionnaires were applied while reliability was ascertained by use of Cronbach's alpha whose obtained coefficient value was 0.7. Data collected has hopefully added to existing knowledge in dairy cattle production in the study area and in Kenya. The data was gathered from LDP dairy cattle farmers and Department of Livestock Programme extension agents in Homa Bay and Ndhiwa sub-counties through face to face interview. It was analyzed using descriptive statistics and multiple regression that was measured at 95% of confidence interval. There was a significant relationship between upgrading of Zebu dairy cows that was measured by number of crosses and run against daily milk yield and current income from milk. There was a significant relationship when fodder production practices measured by acreage allocated for fodder production and number of varieties grown were run against daily milk yield and current income from milk. There was a significant relationship between disease control practices measured by regularity in disease control, adoption of disease control that were run against daily milk yield and current income from milk. These findings indicated that respondents adopted LDP packages and income from dairy cattle production increased. They were able to take their children to school, improve their housing structures and dairy units. Department of Livestock Production should continue sensitizing dairy cattle farmers to enhance productivity in the study area.

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LIST OF ABBREVIATIONS AND ACRONYMS

DAO: District Agriculture Office

FAO: Food and Agriculture Organization

GDP: Gross Domestic Product

GoK: Government of Kenya

KARI: Kenya Agricultural Research Institute

LDP: Livestock Development Programme

MoA: Ministry of Agriculture

MoLD: Ministry of Livestock Development

CHAPTER ONE
INTRODUCTION

1.1. Background Information

Dairy cattle production in most parts of the world started with small scale traditional cattle rearing in the rural areas with an aim of producing milk to feed the family and neighbours. As the herd increased in size production also increased leading to surplus milk which had to find a market in the urban areas (Bee, Musanga & Kavana, 2006). Since independence, Kenya has relied heavily on the agricultural sector which includes Livestock production as the base for economic growth, employment creation and generation of foreign exchange. About 70% of the country's population lives in the rural areas and depends on agriculture and livestock production for livelihood (Government of Kenya (GoK), 2010; 2004; Njugiri, 2007 & Ministry of Livestock and Fisheries Development (MoLFD), 2007). The sector provides food and cash needs of farmers, provides employment to about 10 million people, and contributes ten percent to GDP through sales of milk, milk products, small stock like sheep, goats, chicken and eggs (GoK, 2010; Gangadhar, Satyanarayan & Veeranna, 2009). Kenya is one of the largest producers of dairy products in Africa with about 3.5 million improved dairy cattle, 9 million zebu, 900,000 camels and 12 million goats (GoK, 2007; Ministry of Planning and Finance, 2010 and Omore, McDermontt, Muriuki & Thorpe, 2009). Dairy industry in Kenya is relatively more developed compared to dairy industries in other countries (Muriuki, 2009) and its in view of this that implementation of Vision 2030 is expected to increase income from agriculture, livestock and fisheries production for development and consequent transformation of Kenya into a medium-income country that provides a high quality life to all its citizens (GoK, 2007).

According to the Strategy for Revitalizing Agriculture (SRA) (GoK, 2004), Kenya's ability to exploit fully its potential in livestock production is hampered by diseases such as East Coast Fever and Trypanosomiasis through reduction in returns from livestock production industry. On-farm milk productivity has remained low because of poor animal husbandry, low quality feeds, inadequate and inefficient breeding services and ineffective disease control (MoLFD, 2006). In the Poverty Reduction Strategy Paper for former Homa Bay district (GoK, 2001) current Homa Bay sub-county, improving

productivity of livestock systems was expected to result in employment creation and a significant contribution to poverty reduction in the country. According to Homa Bay sub-county Development Plan GoK (2002), the Kenyan Government planned to develop livestock industry further through enforcing a new National policy to control livestock diseases through enhanced surveillance, vaccinations and controlled movement of animals from neighbouring countries. Dairy animals reared in Homa Bay and Ndhiwa sub-counties are crosses of Ayshires, Jersey and Friesians. Zebu dairy cows and their crosses with European breeds are also reared.

Livestock Development Programme (LDP) was initiated in Homa Bay and Ndhiwa sub-counties and implemented in the following phases; 1991-1994, phase 1; 1995-1997, phase 2; 1998- 2002 phase 3 and the phasing out period was from 2002 to 2003 (Ministries of Foreign Affairs Finland, Finance, Agriculture & Livestock Production, Cooperative Development and Finnish Cooperative Centre, 2003). It was funded by the Finnish and Kenyan Governments and implemented the following packages: Upgrading Zebu dairy cows, fodder production and disease control practices. The programme was implemented in the whole former Nyanza province. Through simple random sampling, Homa Bay and Ndhiwa sub-counties were picked for the research to represent the province. The researcher was interested in determining the extent of relationship between LDP packages and current dairy cattle production in the study area. Available literature from Department of Livestock Production annual report (Ministry of Livestock Development (MoLD), 2008), indicated that no study may have been carried out in the study area to find out the extent of relationship between LDP programme packages and dairy cattle production. The programme was expected to address low genetic potential for Zebu dairy cows, high disease incidences, poor nutrition and low level of dairy management. Under upgrading of Zebu dairy cows package, farmers upgraded their Zebu dairy cows with breeds such as Ayshire, Friesian and their crosses through use of exotic bulls and artificial insemination. On fodder production, LDP farmers were trained on diversification in fodder production, improved management with emphasis on manure application and fodder preservation. Respondents were also trained on disease control practices such as spraying and deworming routines. Target groups were small scale dairy cattle farmers with emphasis on women since the programme focused on improving their socio-economic status and most activities in dairy cattle production are done by women.

1.2. Statement of the Problem

Livestock development programme was initiated to address constraints in dairy cattle production among small scale farmers in Homa Bay and Ndhiwa sub-counties in 1991 and phased out in 2003. The ultimate goal was to raise milk production and improve levels of living of the dairy cattle farmers in Homa Bay and Ndhiwa sub-counties. A study to assess the extent of relationship between LDP programme packages and dairy cattle production may not have been carried out. This study determined the extent of relationship between LDP packages and dairy cattle production in the study area.

1.3. Purpose of the Study

The purpose of the study was to determine the extent of relationship between LDP programme packages and dairy cattle production among small scale farmers in Homa Bay and Ndhiwa sub-counties.

1.4. Objectives of the Study

The objectives were to determine the extent of relationship between:

i. Upgrading of Zebu dairy cows and current dairy cattle production among LDP small scale dairy cattle farmers in Homa Bay and Ndhiwa sub-counties
ii. Fodder production practices and current dairy cattle production among LDP small scale dairy cattle farmers in Homa Bay and Ndhiwa sub-counties
iii. Livestock disease control practices and current dairy cattle production among LDP small scale dairy cattle farmers in Homa Bay and Ndhiwa sub-counties

1.5. Hypotheses of the study

H_{01}. There is no statistically significant relationship between upgrading of Zebu dairy cows and current dairy cattle production among LDP small scale dairy cattle farmers in Homa Bay and Ndhiwa sub-counties

H_{02}. There is no statistically significant relationship between fodder production practices and current dairy cattle production among LDP small scale dairy cattle farmers in Homa Bay and Ndhiwa sub-counties

H_{03}. There is no statistically significant relationship between disease control practices and current dairy cattle production among LDP small scale farmers in Homa Bay and Ndhiwa sub-counties

1.6. Significance of the Study

Livestock production is important in Kenya's economy. It's a source of employment, food and cash to Kenyans and contributes ten percent to gross domestic product (GDP) through proceeds from milk and its products. Livestock production meets socio-cultural roles for Kenyans. Data generated will add to existing knowledge and literature on dairy production in the study sub-counties and in Kenya. It will contribute to investment decisions by the Government of Kenya and her development partners in livestock production. The findings will also give a feed back to policy makers on dairy cattle production and serve as a reference for new programmes in livestock production. Department of Livestock Production will use these results to come up with a policy on dairy cattle production in Homa Bay and Ndhiwa sub-counties.

1.7. Scope of the Study

This study focused on extent of relationship between LDP programme packages and dairy cattle production among small scale farmers in Homa Bay and Ndhiwa sub-counties. It was carried out in Asego and Rangwe divisions in Homa Bay sub-county, Riana, Ndhiwa and Nyarongi divisions in Ndhiwa sub-county. The study was carried out in the two sub- counties because they experience same climatic conditions, have similar livelihoods like other sub-counties in the former Nyanza Province.

1.8. Assumption of the Study

The researcher assumed that respondents would recall activities they carried out during LDP programme implementation and after the programme completion.

1.9. Limitation of the Study

LDP Programme was implemented in former Nyanza, Western and Rift Valley provinces. Due to similarities in climatic conditions, the study was carried out in Homa Bay and Ndhiwa sub-counties in former Nyanza province. Data collected can only be generalized to Homa Bay and Ndhiwa sub-counties.

1.10. Definition of Terms

Dairy Cattle production- It is rearing of dairy cattle for milk production and generation of income. It involves keeping of pure breeds, cross breeds and Zebu cows for milk production (Karanja, 2003). The definition was adopted for the study. Dairy cattle production referred to daily milk yield and current income from milk.

Fodder production- Refers to growing of grasses or legume shrubs that may be annuals, perennials or permanent crops which are grazed on or cut and fed to livestock either green or conserved into hay or silage. (Singh, Chillar, Yadar & Joshi, 2010). In this study, fodder production looked at the number of varieties grown currently, during LDP programme implementation and acreage allocated for fodder production currently.

Livestock development programme (LDP)- This is the programme that was initiated by Finnish and Kenyan Governments to intervene on dairy cattle production which aimed at increasing milk production in Homa Bay and Ndhiwa sub-counties through upgrading Zebu dairy cows, fodder production and disease control (Varvikko, Ojala & Webb, 1993). The research adopted this definition.

Livestock development programme packages- They were trainings that farmers went through during implementation of LDP programme. They included upgrading Zebu dairy cows, fodder production and disease control practices (Varvikko et al., 1993). In this study LDP packages referred to upgrading of Zebu dairy cows, fodder production and disease control practices.

Socio-economic status- An economic and sociological measure of somebody's work experience and social position in relation to others based on income, education and occupation (American Academy of Pediatrics (AAP), 2009). In this study socio-economic status referred to respondents' type of house, whether he or she had a radio, television set, a sofa set, bicycle and level of children's education.

Upgrading in dairy production- Using European breeds of cattle to improve Zebu dairy cows or native breeds from tropical areas to increase milk yields (Syrstad, 2010). The study looked at the number of upgraded dairy cows that respondents had.

CHAPTER TWO
LITERATURE REVIEW

2.1. Introduction

This section explored studies in the area of dairy cattle production. The chapter covered development programmes, milk production in the world and in the tropics. It further explored studies on livestock production and theoretical framework that informed the study. Conceptual framework was outlined showing linkages between variables.

2.2. Development Programmes

These are development approaches with more than one objective to be achieved within a specified time with specific resources. Programmes are initiated for different reasons: To ensure secure source of food and water for the people in both rural and urban; strive to reduce poverty, increase literacy and create jobs. Development programmes also enhance technical cooperation between industrialized and non industrialized nations, and bridge the gap between the desire for human development and the ability to achieve the goal (UNDP, 2010). Comprehensive Africa Agriculture Development Programme (CAADP) brings together key players at continental, regional and national levels to improve coordination, share knowledge on agriculture and rural development. The programme focuses on environmentally sound agricultural production and a culture of sustainable management of natural resources in Africa. Members for CAADP have a target growth of 6%. Countries such as Angola, Ethiopia, Tanzania and Guinea-Bissau among others have exceeded their agricultural growth rate target (New Partnership for Africa's Development (NEPAD), 2010). National Agriculture and Extension Programme (NALEP) was an example of development programmes implemented in Kenya. It was initiated in 2000 and ended in 2012. Its ultimate goal was to contribute to socio-economic development and poverty alleviation through adoption of sustainable technologies for resource management in agriculture and livestock development (MoA & MoLD, 2009). The LDP programme being one of development programmes, it targeted increasing milk yields in Homa Bay and Ndhiwa sub-counties (Varvikko et al. 1993) and consequently the national and global milk yields.

2.3. World Milk Production

Dairy farming in most parts of the world started with small scale traditional cattle rearing in the rural areas with an aim of producing milk to feed the family and neighbours. As the herd increased in size, production also increased leading to surplus milk which had to find a market in the urban areas (Bee, Msanga & Kavana, 2006). A number of countries in England and Scotland are extensively engaged in production of milk and its products (Sutherland, 2010).

India is the world's largest milk producing country. Its total milk production increased from 48 million tons in 1998-89 to 112 million tons in 2009-10. Nearly two thirds of farm households are associated with livestock production and 80% of them are smallholders (Singh & Datta, 2010). Milk production is a large growing component of agriculture in United States of America. It has been one of the major constituents of diets for infants, children and adults. Due to this, its production has increased as the number of people increases (Nerens, 2010). In Mongolia a programme was set up to initiate milk production groups, dairy centres that practiced proper feeding, disease control measures and cow genetic improvement. The aim was to enhance production of quality milk from profitable cows through using modern farming practices to improve rural income and responsible management. The programme contributed to high milk yields in that country (Tsetsegee & Brian, 2006).

2.4. Milk Production in the Tropics

Tropical areas lie between Tropic of Cancer and Capricorn that are on latitudes 23.5^0 North and 23.5^0 South of the Equator. These areas are characterized by warm temperatures because of receiving direct rays from the sun most of the year. High temperatures in the tropics reduce availability of adequate feeds and diseases caused by organisms that thrive well in hot areas are a challenge unless controlled. Due to this, East Africa experiences economic poverty, families are caught in a downward spiral of poverty, low food intake, poor education and health services. Despite this, smallholder dairy is a long lasting strategy to increase household income, provide reliable livelihood and promote women's social and economic status (East Africa Dairy Development (EADD), 2009). Milk production in the Tropics is based on bovine population with low productivity and conversion of feeds and fodders into milk.

Livestock production systems in Africa and the near East are inefficient and offer much scope for improvement. There is poor animal health, accompanied by high mortality in early life and slow weight gain (Philips, 2001). Milk production in smallholder sector is constrained by a number of factors. The major ones are level of feeding, animal genetics and disease challenges (Muriuki, 2001). As noted by Wesonga, Kitala, Gathuma, Njenga & Ngumi (2010) diseases are an important constraint to improvement of the livestock industry in large areas of East, Central and Southern Africa. Some diseases have adverse effects on dairy cattle production even after treatment. For example mastitis can damage milk secreting ducts and occasionally permanent damage to the udder may result affecting milk production (Agriculture & Horticulture Development Board (AHDB), 2014). Mastitis is a limiting factor to profitable dairy production since it causes a lot of losses through discarded milk due to antibiotics, decreased milk production, alterations in milk quality and veterinary costs (Oliver, Murinda & Almeida, 2010). Dairy cattle production is done at different levels depending on its level development and the Country. In Zambia the industry is divided in two categories: commercial and small scale sub-sectors. Commercial sub-sector is practiced by large and medium scale farmers and expatriates who rear European breeds because they are high yielders and are able to control diseases on time while the small scale comprises of mostly crosses and a few European breeds (Kaluba, 2010).

Milk production in tropics is also affected by inadequate and poor quality fodder. In most third world countries animals survive on poor quality roughages and crop residues which are deficient in many nutrients. Such feeding results in protein deficiency due to low digestible crude protein which results in loss of body condition and low milk production in lactating cows (Honnappogol & Tandle, 2010). A few farmers feed their dairy animals on adequate legume forage which is usually rich in protein and contains a large portion of digestive amino acids essential for high milk yields (Singh, Chillar, Yadar & Joshi, 2010). Other farmers utilize none-protein nitrogen sources for example urea, to compensate for lack of nitrogen in fibrous feeds fed to dairy animals (FAO, 2007). In Ethiopia livestock farmers suffer from feed shortages due to seasonality in production. To cope with the scarcity they harvest and conserve crop residues at the end of each season. This has led to increased use of crop residues for livestock feed and increased reliance on purchased feeds to support livestock production. In view of this, the country

initiated Ethiopia Livestock Feeds project funded by Australia Centre for International Agricultural Research (ACIAR) led by ILRI to design feed-based interventions to reduce feed scarcity for dairy cattle production in Ethiopia (Thorpe & Duncan, 2012). The intervention improved accessibility to feeds by livestock farmers. Animals became healthier due to availability of adequate feeds. This contributed to increase in milk yields hence improved income.

Type of breed affects milk yield as observed in European breeds which produce more milk than crosses or local breeds. A similar trend was reported in Zambia where most large scale dairy farmers rear Friesians which produce an average of 25 litres of milk per day while most small scale farmers keep crosses of Friesian and local breeds that give about 10 litres per day (Kaluba, 2010). The main purpose for dairy cattle farming is to produce milk, reproduce to provide replacement stock and provide an income to the farmer. The dairy breeds that can accomplish this are the European breeds because they are high yielding than crosses and local breeds (Xtalia, 2011). Despite European breeds being high yielding and predominantly dairy breeds for temperate countries, Tadessa and Dessie (2003) observed that they have also been introduced in the tropics due to their high potential in milk yield. LDP aimed at increasing milk production which would translate into improved levels of living for the target groups through packages on upgrading Zebu cows, promotion of fodder and disease control practices. This research was aimed at finding out the extent of relationship between LDP packages and dairy production in Homa Bay and Ndhiwa sub-counties.

2.5. Milk Production in Kenya

Kenya's milk production increased from 2.8 billion litres in 2002 to 4.2 billion litres in 2009 with an average of 5.7 litres of milk per cow. However production is low when compared to 7 litres for world average (Ministry of Agriculture, 2010). Kenya has been self sufficient in milk and milk products except in years of extreme bad weather and its consumption in the country is in form of liquid milk (Muriuki, 2001). The Kenyan Government in collaboration with International Livestock Research Institute (ILRI), Kenya Agricultural Research Institute (KARI) and the British Government for International Development offers help to dairy farmers through smallholder dairy projects (Salmon, 2007). A lot of work is being done by researchers and farmers to

improve milk production due to increase in demand for dairy products (Omore & Besseling, 2009). Due to this, dairy production in Kenya is the most advanced in sub-Saharan Africa since it has an organized marketing infrastructure.

Besides feeds and animal diseases, dairy breed influences milk production in Kenya. Farmers rear European and Zebu cows for milk production. The European breeds produce more milk than the Zebu cows (Karanja, 2003). Adoption of LDP Programme packages was to contribute positively towards dairy production and thereafter improve livestock production in Kenya. This was to be done through upgrading of Zebu cows, fodder production and disease control practices among dairy cattle farmers in Homa Bay and Ndhiwa sub-counties.

Semi-arid pastoral areas are susceptible to climate variability subjecting household and livestock to drought and floods. In Dertu Millennium Village of northern Kenya, drought in 2006 led to deterioration of pastures and water supplies for livestock (Standing Committee on Nutrition (SCN), 2010). Yet proper feeding contributes to fertility required for initiation of the first lactation and dairy survival (Hare, Norman & Wright, 2006). Scarcity of animal feeds has been associated with a lot of losses of livestock, livelihood assets and rising poverty. Fodder production and conservation have been identified as an appropriate intervention towards improving household nutritional status and alleviating poverty in Garissa sub-county. This is possible through improved community managed disaster risk reduction against impact of drought by providing surplus feeds to dairy animals (ADESO (African Development Solutions), 2012).

Productivity of dairy animals in Kenya is also affected by animal diseases. Tick borne diseases for example, East Coast Fever has a negative economic impact on dairy production in the tropics (Muriuki, 2001). The disease contributes to a lot of losses in dairy production either through death or high costs of medication (Wesonga et al., 2010).

2.6. Upgrading of Livestock in Relation to Milk Yields

Upgrading involves use of European breeds to improve on milk production in local breeds. European breeds are dairy animals from Europe and have high milk production levels. They include: Friesians, Ayrshires, Gurnsey, Jersey and their crosses. Cross

breeding of European dairy breeds with native breeds from tropical areas has been used widely as a method to improve milk production in the tropics. Indigenous animals can survive on less feed and water for some time, however their dairy potential is poor due to late maturity and do not let down milk unless stimulated through sucking by calves (Syrstad, 2010). Improvement through upgrading and subsidized feeds and medication to the sub sector can enhance high output from Zebu dairy cows (GoK, 2001). In a study in South Wollo zone of Amhara State of Ethiopia, milk yields and reproductive performance of 16 indigenous and 16 crossbred cattle under smallholder management conditions were assessed for five months. Results indicated that daily milk yields at all stages of lactation were significantly higher in crossbred than in indigenous cows (Abraha, Belihu, Bekana & Lobago, 2009).

A study done in Tanzania by Bee, Msanga and Kavana (2006) on lactation performance of upgraded cattle under farmers' management indicated that second generation (filial $_2$ (F_2)) of crosses produce more milk than first generation (filial $_1$) because genetic potential for milk production in filial 2 (F_2) is higher than in the F_1. Further, Bee et al. (2006), while working with crossbred dairy cattle in Arsi, Ethiopia reported that crossbreeding Zebu with exotic dairy cows doubled milk yields. In Ethiopia, Tegegne, Gebremedihin, Hoekstra and Alemayehu (2010) observed that dairy production was mainly at subsistence level mostly based on indigenous breeds of cattle whose production was not enough to support the demand of increasing human population particularly in urban centres. Tegegne et al (2010) established Ada'a Dairy Cooperative that embraced market oriented urban and peri-urban dairy production systems, based on up-grading dairy stock and purchase of conserved feeds. Milk supply in the country has increased by the cooperative increasing their production from 288,000 litres in 2000 to 2000about 2.6 million litres in 2005.

Upgraded cows have been accepted in Malawi by smallholder farmers because they have high production potential than the Zebu (Munthali, Musa & Chiwayula, 2010). In Zambia, milk in traditional sector was produced from local cattle mostly of the Sanga and Zebu types crossed with Tonga and Barotse which resulted in low production. In 1979 the Government established a cross breeding ranch at Batoka with the assistance of the European Economic Commission (EEC). The ranch provided in-calf upgraded

heifers to farmers in settlement and smallholder dairy projects which resulted in high milk yields through crossing local cows with European breeds which contributed to high milk production for commercial purposes (Kaluba, 2010). In Velica Ivanca of Yugoslavia, farmers raised 'busha', a local breed of dairy animals. A few farmers started importing improved breeds from Switzerland to improve genetic structure of the local breeds. By 1977 milk production had increased due to upgrading the 'busha' with breeds from Switzerland which translated in higher income for farmers (Krstic, Breisavljevic & Ristic, 2009).

Influence of breed on milk yields is shown by a study conducted in Sudan. The research was carried out in Nyala city the capital of Darfur in Western Sudan on three types of local breeds; Fellata, Kenana and Kenana crossed with a Friesian. They were subjected to same conditions and milked manually twice per day. Average milk during the first 90 days post partum was 1.4-2.3 litres /day for Fellata, 4.5-5.4 litres/day for Kenana and 9.1-13.6 litres /day for the Kenana crossed with a Friesian. Kenana crossed with a Friesian had the highest yields attributed to crossing the local breed with an improved one (Abdalla & Elsheikh, 2008). Another study in the same country was carried out at Ghazala Gawazat Research Station in Western Sudan to utilize advantage of heterosis. It involved Kenana, Butana and Western offspring from Butana and Kenana bred to European bulls. The results showed that crosses between local breed and western dams had 8.5% and 25% higher lactation and milk yield respectively (Ageeb, 2006). Livestock Development Programme targeted improving dairy potential of Zebu in Homa Bay and Ndhiwa sub-counties through upgrading using European dairy cows and bulls to improve the level of dairy production in the study area. Increased milk yield was meant to improve income earned from milk and change socio-economic status of the farmers in the study area. This study aimed at determining the extent of relationship between upgrading Zebu cows and dairy cattle production. This study determined the extent to which respondents continued using the technology on upgrading. The extent of relationship may not have been documented by earlier researchers in the same location and technology.

2.7. Fodder Production in Relation to Milk Yields

Fodder shrubs give the best returns when they are fed to improved dairy cows because of

the potential they have for milk production than local breeds. Milk production from upgraded cows previously fed on grasses and crop residues increase sustainably if their diet is improved with high protein fodder shrubs (Wambugu, Franzel, Cordero & Stewart, 2006). Major problem in dairy production in most areas is poor management of fodder resulting in low production from natural and improved pastures. Stocking density should provide enough forage to enable the cows to produce 90% of their potential and the balance to come from supplements (Phillips, 2001). In case of deficiency of multiple nutrients for example energy, proteins, mineral salts and vitamins is detected, multi-nutrient blocks can be used (Patil, Mathur, Patel, Patidar & Mathur, 2010). Without progress in agriculture, poverty and low productivity situation in dairy may not improve and agro-based industries are likely not to prosper (Bhatia & Batra, 2003). Dairy science requires that a dairy animal consumes 3% of its body weight on dry matter (Agricultural Society of Kenya (ASK), 2010). Proper feeding is an important issue in dairy production since it accounts for 40% of production costs. Conserved hay, agro-industrial by-products and commercial concentrate rations are the major feed resources used by dairy farmers and they contribute to high milk production (Tegegne et al. 2010).

Most dairy farmers in Kenya feed their animals on feeds that are deficient in quality, quantity, concentrate and mineral supplement besides limited access to fodder and water in dry season contributing to lower milk production than expected (GoK, 2007). Nutrition plays important roles in keeping cattle healthy and strong therefore implementing an adequate nutrition programme can also improve milk production and reproduction performance. Supplementing dairy cows that feed on tropical grasses with lucerne can raise milk production from 10-12 to 14-15 litres per cow per day (Infonet, 2010). Poor quality forages complicate the delicate matter of energy balance due to lower voluntary dry matter intake by dairy animals yet for high milk production, dairy cows need 16 kg of dry matter per day (Guthrie & West, 2010). Research carried out in Punjab, Pakistan by Javed (2004) on environmental factors that affect milk yields in Friesian cows, established that variations in seasons had an influence on milk production. Cows that calved down in autumn produced maximum levels of milk due to availability of fodder and cool temperatures. Those that calved down in spring were second in production while the lowest production was experienced amongst cows that calved down when it was dry and hot. A study by Singh (2005) in Kashmir Valley discovered that

holding other factors constant, milk production increased with feeding of digestible crude protein and total digestive nutrients until genetic limit of animals was reached. In Netherlands research findings by Elgersma, Dukstra and Tamminga (2006) showed that for every 10% increase in grazed grass in dairy cow ration, milk production costs reduced by 2.50 cents and lactating cows take between 20-50 % herbage more than none lactating ones. It was in view of this that LDP chose fodder production as one of its components in order to improve feeding levels of dairy animals in the study area and enhance dairy production with reduced nutritional deficiency disease. The study aimed at finding out the extent of relationship between fodder production and dairy cattle production in the study area. Other researchers may have carried out studies on upgrading in the same study location but did not determine the extent of continued use of the technology hence the necessity of this study.

2.8. Disease Control Practices in Relation to Milk Yields

Obtaining high quality and quantity of milk from dairy enterprises is the main target for dairy industry in many countries (Erdem, Atasever & Kul, 2010). Livestock diseases lead to mortality and reduced productivity in farm animals which contribute to increased expenditure for prevention and control. Diseases limit objectives of livestock keepers to improve on income from dairy cattle production, human health is threatened and affects the ability to exploit potential in livestock production due to diseases brought about by ticks, tsetse flies and livestock movement (FAO, 2007a & GoK, 2010). Disease prevalence in livestock industry reduces trade and returns in investment (GoK, 2004; Gikungu, 2005; Muhammad, Naureen, Firyal & Saqib, 2008). Since diseases reduce animal productivity, farmers who are first line of defense against any disorder must have a functional dairy service to integrate all aspects of care, particularly disease eradication campaigns to cater for the health of the individual cow (Gietema, 2005). Surveys on calf and the entire dairy management, morbidity and mortality in the United States of America have been conducted in the last 25 years and have placed renewed focus on pre-natal calf health since healthy calves under better management result in high returns through increased milk production (LeBlanc, Lissemore, Kelton, Duffeild & Leslie, 2006). These authors further observed that the biggest single advance in dairy health in the past has been a paradigm shift from treatment of clinical illness to disease prevention which is contributed by advances in science and technology for reduction in disease

incidences. Research carried out in Burkina Fasso, Guinea and Mali (Neun, 2010), found out that farmers play an important role in successful management of diseases such as trypanosomiasis and recommended more support for community based treatment. Efficient and reliable animal health services are crucial to a vibrant dairy industry.

The Ministry of Livestock Development (2006) in Kenya indicated that productivity and profitability of dairy production depends on effective disease control. According to Oliver, Murinda, & Almeida (2010), mastitis reduces milk yield and alters quality through influence of severe inflammatory response caused by the infection. Cows suffering from mastitis produce little and contaminated milk. Disease control was one of LDP's objectives and it focused on controlling diseases in dairy cattle to have healthy animals that would result in increased number of dairy animals and milk yields thereby elevating economic status of the farmers. The study determined the extent of relationship between Livestock Development Programme package on disease control practices and dairy cattle production in Homa Bay and Ndhiwa sub-counties. The researcher's findings showed the extent of relationship between LDP package on disease control practices and dairy cattle production in Homa Bay and Ndhiwa sub-counties which may not have been documented by earlier researchers hence the need for this study.

2.9. Theoretical Framework

The study on relationship between LDP packages and dairy production in Homa Bay and Ndhiwa sub-counties was guided by diffusion of innovation theory. This is a theory of how, why, and at what rate ideas and technology spread through cultures. Rogers (2003), defines diffusion as a process through which an innovation is communicated via certain channels over time among members of social system. The theory has various concepts: complexity; which refers to the degree of difficulty in understanding and implementing the practice, compatibility relates to degree to which the practice is compatible with current objectives of the programme participants; while triability deals with the potential to experiment the practice on a smaller and less intensive scale. Relative advantage is concerned with the possibility of increased income or other factors that may make adopting a practice advantageous over alternatives. Observability is concerned with opportunity to see the results of the practice. The theory assumes that individuals pass

through five stages of adoption process: Knowledge, persuasion, decision making, implementation and confirmation when adopting an innovation. Diffusion of an innovation takes place when there is an innovation, communication, time for adoption, channels and social system which frame the innovation decision process. LDP went through same process before implementation of the programme. The technologies: upgrading Zebu cows, fodder production and disease control diffused to dairy farmers through guidance from Department of Livestock staff who explained to farmers what the programme entailed and participated in its implementation. The farmers got knowledge from the LDP implementing staff about the packages of the programme, went through persuasion stage, made a decision to implement the programme and confirmation was done by the initiation of the programme. LDP packages being better than the previous practices in dairy cattle production, it was expected that respondents would adopt them and continue applying them. This would contribute to improved dairy cattle productivity.

2.10. Conceptual Framework

The independent variable was LDP packages which composed of upgrading Zebu dairy cows measured by number of upgraded cows, fodder production practices which were measured by acreage allocated after LDP and varieties of fodder grown currently and disease control practices measured by regularity in disease control and adoption of disease control. Dependent variable was dairy production measured by daily milk yield and current income from milk while moderator variables were age, gender, farm size, marital status and level of education (Figure 1). Both independent and moderator variables were run against dependent variable to find out if moderator variables influenced variance in dependent variable. LDP packages were adopted by respondents, dairy production improved by respondents using these technologies to make changes in dairy production activities. This had a positive impact on dairy cattle production and translated in improved income.

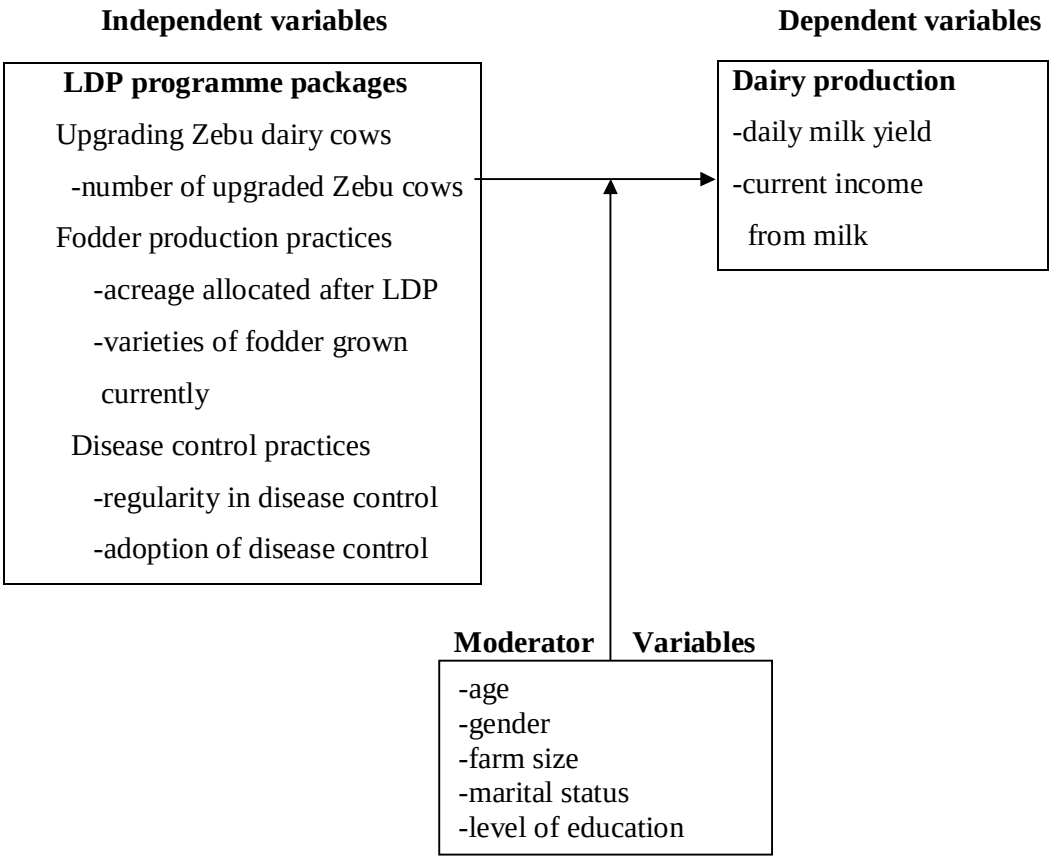

Figure1. Conceptual Framework for Determining Relationship between LDP Packages and Current Dairy Cattle Production

CHAPTER THREE
METHODOLOGY

3.1. Introduction

This chapter covers the research design, description of the study area, population of the study, sample size and sampling procedures, data collection tools, data collection procedures and data analysis.

3.2. Research Design

The study was conducted using a survey that adopted a descriptive and correlation design. Descriptive statistics were used in discussing demographic data in the study while correlation looked at the strength of the relationship between LDP packages and current dairy cattle production. The design was suitable because respondents had equal opportunities to participate, conditions were not altered and data was collected by asking all respondents in the sample similar questions through an interview schedule and a questionnaire. This was a cross-sectional study and results obtained could be generalized on a bigger population. The design enabled the researcher to gather data on how respondents carried out dairy cattle production activities (Borg & Gall, 1989) during and after LDP implementation in relation to the programme packages in Homa Bay and Ndhiwa sub-counties.

3.3. Area of Study

Homa Bay and Ndhiwa sub-counties had 366,620 people, constituted by 174,306 males and 192,314 females according to Ministry of Finance and Planning-Central Bureau of Statistics (2009). The research was carried out in Asego, Rangwe, Nyarongi, Ndhiwa and Riana divisions in Homa bay and Ndhiwa sub-counties. Ecological zones in the areas range from Lower $Midland_2$ to Lower $Midland_4$ (LM_2–LM_4). Rainfall patterns are bimodal with long rains being received between February to June (450mm-1000mm) per annum while the short rains are received in September–December (250mm–700mm) per annum with 60% and 25% reliability respectively. Livelihood of the people in the study area is crop production, livestock rearing and fishing.

3.4. Population of the Study

Target population for the survey was all dairy cattle farmers in Homa Bay and Ndhiwa sub-counties. Accessible population was 1044 LDP dairy cattle farmers who implemented the programme (Ministries of Foreign Affairs Finland et al., 2003).

3.5. Sampling Procedure and Sample Size

The following divisions: Asego, Rangwe, Ndhiwa, Nyarongi and Riana were selected through purposive sampling because they implemented LDP programme and therefore had the required information with respect to the objectives of the study. A sampling frame that had 1044 dairy cattle farmers who implemented the programme was provided by the Department of Livestock Production in Homa Bay sub-county. Kathuri and Pals (1993) recommend not less than 100 respondents for a survey research to reduce on sampling error while Borg and Gall (1989) recommend more than 100 respondents to reduce sampling error. On this basis a sample size of 150 was used since it met the threshold and it was also large enough to reduce sampling errors. The farmers' names per division were written and put in a container for sampling. Mugenda and Mugenda (1999) recommend writing numbers given to each accessible member of the population and putting them in a container for sampling. Using the sample size of 150, proportionate random sampling was used to get the number of respondents required per division which was picked from the container until the target for each division was achieved. The total number of respondents from all divisions totaled to 151. The sample size for the study was 151 respondents so as to reduce on sampling errors. Twelve extension agents from the Department of Livestock Production were purposely selected from the rest of the staff as key informants since they participated in LDP programme implementation.

3.6. Instrumentation

Interview schedules and questionnaires containing open and closed ended questions were used. An interview schedule was suitable for dairy farmers because some of them were unable to read and write. The interview schedule enabled the researcher to ask for more information and clarification from respondents. The schedule enabled the researcher to obtain data needed to meet specific objectives of the study without wide variations in responses. A questionnaire was suitable for staff because they were able to read, write and explain. An interview schedule (Appendix A) had five sections. Section A gathered

demographic data and B collected data on upgrading Zebu dairy cattle. Section C gathered data on fodder production practices, section D was on disease control practices and section E collected data on socio-economic status of LDP farmers. Questionnaire (Appendix B), was used to gather data from extension agents in State Department of Livestock Production in Homa Bay and Ndhiwa sub-counties.

3.6.1 Validity

Validity refers to the suitability and consistency of an instrument to measure concepts without bias or error therefore enhancing collection of relevant data for a survey. Construct and face validity were ascertained by a panel of experts composed of supervisors in the Applied Community Development Studies Department and the researcher's colleagues. The researcher used expertise from the panel to improve on the instruments.

3.6.2 Reliability

The interview schedule was pilot-tested in West Kanyada location in Asego division on 13% (20) members of the sample size. Mugenda and Mugenda (1999) recommend between1% to 10% (2- 15) members of the sample size. The researcher pilot-tested the interview schedule on 20 respondents to determine reliability of the tools. This location was excluded from the research to ensure that respondents in the research were different from the ones used in pilot-testing. Through simple random sampling, 7 extension agents from the Department of Livestock Production in Mbita sub-county were picked and a questionnaire pilot-tested on them. Mbita is one of the sub-counties that implemented LDP Programme in the former Nyanza Province. Data were analyzed using Cronbach's alpha and corrections made to the tools to increase their reliability. Cronbach's alpha is more suitable since it takes less time to compute reliability, it gives conservative estimates of reliability which give lower coefficient that reduce chances of making erroneous conclusions. Other methods over-estimate coefficient which may result in erroneous conclusions (Mugenda & Mugenda, 1999).

Cronbach's alpha;

$$\alpha_{standardized} = \frac{K \bullet \bar{r}}{\left(1 + (K-1) \bullet \bar{r}\right)}$$

The obtained coefficient value was 0.7. DeVellis (2003) recommends 0.7 coefficient

value to increase reliability of an instrument.

3.7. Data Collection Procedure

A research permit to authorize the study was sought from National Council of Science and Technology now referred to as National Commission for Science, Technology and Innovation (NACOSTI) by the researcher through graduate school of Egerton University. Department of Livestock Production in the research area was informed about the study. Data was collected from LDP dairy cattle farmers through face to face interviews and from extension agents through self-administered questionnaires. Response rate for the study was 100 % since the research applied interview schedules through which the researcher interviewed respondents and recorded responses at the same time. For extension agents, the researcher met each one of them, gave a questionnaire which was filled and given back after filling. All the respondents that were interviewed provided information that was required by the study.

3.8. Data Analysis

Data gathered was analyzed using descriptive and inferential statistics with the aid of Statistical Package for Social Sciences (SPSS). The descriptive statistics included percentages and frequencies while inferential statistics used was multiple regression analysis. Number of upgraded cows, acreage allocated for fodder production after LDP, varieties of fodder grown currently, regularity in disease control and adoption of disease control (independent variables) and moderator variables (marital status, age, gender, farm size and education level) were run against dairy production (daily milk yield and current income from milk). Regression analysis was applied to test hypotheses of the study and to determine the extent of relationship between independent and dependent variables. Variables that were on nominal scales for example gender and marital status were assigned dummy codes to allow them to be used in the multiple regression analysis. Nominal variables can be entered into regression as long as they are dummy coded (Moss, 2008). It was necessary to look at assumptions that guided the statistical procedures selected for analyzing data to establish whether they had been met or not. One of the assumptions in multiple regression analysis that was considered was normal distribution of variables. Data was subjected to skewness test which indicated normal distribution of variables.

Table 1. Summary of Data Analysis

Hypothesis	Independent variable	Dependent variable	Statistics
H_{o1}. There is no statistically significant relationship between upgrading of Zebu dairy cows and current dairy cattle production among LDP small scale dairy farmers in Homa Bay and Ndhiwa sub-counties	-Number of upgraded cows	-Daily milk yield -Current income from milk	-Multiple regression -Descriptive statistics: frequencies and percentages
H_{o2}. There is no statistically significant relationship between fodder production practices and current dairy cattle production among LDP small scale dairy farmers in Homa Bay and Ndhiwa sub-counties	-Acreage allocated fodder after LDP -Varieties of fodder grown currently	-Daily milk yield -Current income from milk	-Multiple regression -Descriptive statistics: frequencies and percentages
H_{o3}. There is no statistically significant relationship between disease control practices and current dairy production among LDP small scale dairy farmers in Homa Bay and Ndhiwa sub-counties	-Regularity in disease control -Adoption of disease control measures	-Daily milk yield -Current income from milk	-Multiple regression -Descriptive statistics: frequencies and percentages

CHAPTER FOUR
RESULTS AND DISCUSSIONS

4.1. Introduction

This chapter presents results of the study carried out in Homa Bay and Ndhiwa sub-counties. The first section is on social and demographic characteristics of respondents. The sections that follow address study objectives on upgrading of Zebu dairy cows, fodder production practices and livestock disease control practices. The study adopted both qualitative and quantitative types of research.

4.2. Social and Demographic Characteristics of Respondents

Respondents comprised 64% women and 36% men. Women were more than men because LDP targeted women. About 60% were in the age range of 49-60 years while the rest (23%) were over 60 years old. Study results indicated that most of the respondents were middle aged (between 49- 60 years). This explained the fact that many elderly people engage in farming compared to the young who migrate to urban centres to seek employment. Majority of the respondents (76%) reported being married and 21% were widowed. The programme targeted adults in implementing the programme hence majority reported being married while others died through natural attrition resulting in 21% being widowed. Regarding education, 43% had primary education, 25% had secondary education while about 23% had tertiary education. These findings showed that most of the respondents had formal education which contributed to high adoption of the LDP programme packages. Average family size in Homa Bay and Ndhiwa sub-counties was nine members per household. About 82 % of respondents were able to pay school fees for more than 6 children while 11% were able to pay school fees for children between 5-6. Findings indicated that respondents' income increased and they were able to take their children to school (Table 2)

.

Table 2. Social-Demographic Characteristics of the Respondents

Characteristics	Frequency (f)	Percentage (%)
Gender		
Male	54	35.4
Female	97	64.2
Age		
43-48 years	26	17.2
49-54 years	42	27.8
55-60 years	49	32.5
61-66 years	21	13.9
Above 66 years	13	8.6
Marital status		
Married	114	75.5
Single	2	1.3
Divorced	1	.7
Separated	2	1.3
Widowed	32	21.2
Farmer's level of education		
Not gone to school	15	9.9
Primary	65	43
Secondary education	37	24.5
Tertiary education	34	22.5

Forty one percent (41) of the respondents had 4 children who had completed form four. This showed that literacy levels in respondents' children were high due to improved income from milk. This agrees with extension agents who reported improved income from milk due to adoption of the LDP packages that enabled respondents to meet their basic needs.

4.3. Relationship between Upgrading of Zebu Cows and Dairy Cattle Production

The first objective of the study was to determine relationship between upgrading Zebu dairy cows and current dairy cattle production among LDP dairy cattle farmers in Homa Bay and Ndhiwa sub-counties. The aim was to find out if the respondents were implementing packages in upgrading of Zebu dairy cows from LDP trainings and the influence on dairy cattle production. Questions asked included; number of initial Zebu cows, whether they still had some Zebu dairy cows, current upgraded Zebu dairy cows, dairy systems of rearing used during and after LDP implementation, milk increase, current milk yield, milk consumed at home, number of cows in milk, records kept and their opinion on information passed to them in LDP trainings. LDP programme used European bulls and artificial insemination in upgrading the Zebu dairy cows. There were respondents who were identified to keep the bulls for serving Zebu cows in the community. Artificial insemination was run by Veterinary Department to supplement services by bulls.

Prior to LDP implementation, 42% had between 3-4 Zebu dairy cows, 29% had between 5-6 while 27% had between 1-2. The number of respondents with 1-2 upgraded zebu dairy cows increased from 41 to 123. However those with more than 3 Zebu dairy cows reduced possibly due to the fact that some respondents did not control diseases on time which resulted in some of the animals dying. The results indicated that more farmers adopted the package on upgrading their Zebu cows which improved their productivity resulting in improved socio-economic status of the respondents as reported by extension agents. All respondents still had some Zebu dairy cows that were not upgraded attributing them to tolerance to pests and diseases, cheaper to maintain, for funeral ceremonies and as a source of money for school fees. After programme implementation, 82% had between 1-2 un upgraded Zebu dairy cows, 16% had 3-4, 3% had between 5-6 Zebu dairy cows. The findings indicated that most respondents (82%) upgraded their

Zebu dairy cows leaving between 1-2 Zebu cows. More than half of the respondents (65%) were very timely in heat detection which contributed to 65% achieving successful service of their Zebu cows without repeating services. About 31% repeated their service twice before the cows conceived while 4% had to serve three times for the cows to conceive. This showed that respondents accepted upgrading and adopted it hence the keen interest in heat detections that contributed to fewer repeat services.

Another component of upgrading that was considered was production system. Results showed that tethering system reduced. Many respondents adopted the semi-zero production system which could be explained that they did not have sufficient time to take care of dairy cows in their units and fodder to practice complete zero grazing system. When the programme was adopted milk yield increased. For example 45% of respondents had an increase between 3-4 litres, 41% got between 1-2 litres, while 9% got between 4-5 litres. About 45% earned between 120-160 shillings from milk per cow per day, 41% got between 40-80 shillings while 9% got between 160-200 shillings. This increase was reflected in improved income that made respondents economically stable as reported by most respondents and extension agents from the Department of Livestock Production. Most of the respondents (70%) had 2 cows in milk, 19% had 3 while 11% had 1 cow in milk. Milk records that were kept by respondents included dates of: Service, vaccination and deworming. Milk yield records were also kept by respondents. About 38% kept three types of records (service, vaccination and milk yields) 19% kept 4 (service, vaccination, milk yields and deworming) while 19% kept 1 record (milk yields).

Table 3. LDP Package on Upgrading Zebu Dairy Cows against Current Upgrading of Zebu Dairy Cows.

Characteristics	**During LDP Programme implementation**		**After LDP Programme**	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Upgraded Zebu Dairy Cows				
1-2	41	27.2	123	81.5
3-4	63	41.7	24	15.9
5-6	43	31.2	4	2.6
System of Production				
Tethering	20	7.3	12	8
Semi-zero grazing	86	57	122	74.1
Zero grazing	44	29.1	24	15.8
Free range system	1	.7	9	4.9
Milk yield				
1-2 litres	62	41.1	13	8.6
3-4 litres	68	45	58	38.4
4-5 litres	14	9.3	51	33.8
6-7 litres	7	4.6	28	18.5

The First Hypothesis stated that there is no Statistically Significant Relationship between Upgrading of Zebu Dairy Cows and current Dairy Cattle Production among LDP Dairy Farmers in Homa Bay and Ndhiwa Sub-Counties.

Upgrading of Zebu dairy cows in objective one was measured by number of upgraded cows as the independent variable while the dependent variable was dairy cattle production measured by daily milk yield and current income from milk. The following moderator variables; age of respondents, gender, farm size, marital status and level of education were built into the study as independent variables and incorporated in the analysis to determine variance in the dependent variable (Table 4).

Table 4. Relationship between Number of Upgraded Cows and Daily Milk Yield

Variable	b	Standard error	Beta (Standardized Coefficient)	Zero order Correlation coefficient	Partial correlation coefficient	t
Number of upgraded cows	.581	.149	.275	.241	.278	3.470*
Age	.071	.063	.089	.052	.093	1.117
Gender *Male (1) vs Female (0)*	.017	.161	.009	.009	.008	.107
Farm size	-.205	.090	-.182	-.152	-.187	-2.284*
Marital status *Married (1) vs not married (0)*	.013	.046	.024	.002	.023	.293
Education level	.104	.060	.137	.136	.142	1.725
Constant	1.866	.473				3.949

R=.343; R^2=.117; df=6; 150; F= 3.194; p<.05, * significant at .05 level

The data was analyzed using regression method by running number of upgraded Zebu cows and moderator variables: Age, gender, farm size, marital status and education level against daily milk yield. Number of upgraded Zebu cows and moderator variables: Age, gender, farm size, marital status and education level were run against current income from milk. The first multiple regression analysis determined the extent to which the number of crosses, age, gender, farm size, marital status and education level explained the variance in daily milk yield. The model was statistically significant indicating a relationship between upgrading and dairy cattle production ($F= 3.194$; $df =6, 150$; $p<.05$). The independent variables accounted for 11.7 % of the variance in the dependent variable.

Number of upgraded cows was significant in the model probably due to the fact that high number of upgraded cows contributed to increased daily milk yield. This showed that a high number of upgraded cows under good management translated in increased daily milk yield. Farm size was significant although negative. This was an indication that most respondent allocated less land for dairy production and had other ways of ensuring that there was enough fodder for dairy animals through hiring of land for fodder production or buying fodder from other sources. Age, gender, marital status and education level did not influence daily milk yield. It implied that both men and women, people of different ages, single, married, educated and none educated respondents had similar opportunities to upgrade their Zebu dairy cows and have many upgraded cows. Therefore LDP trainings resulted in respondents upgrading their Zebu cows which in turn translated into higher daily milk yield.

A second regression analysis was run to establish how number of upgraded cows, age, gender, farm size, marital status and education level accounted for the variance in current income from milk. The model was significant and explained 2.6 % of the variance in dependent variable. However none of the individual variables showed significance. Absence of a significant relationship between number of upgraded cows and current income from milk could be explained by the fact that fewer or many upgraded cows under better management would increase daily milk yield which would result in increased current income from milk. Age of respondent did not influence current income

from milk possibly because opportunities for increasing current income from milk were open to all respondents regardless of age (Table 5).

Table 5. Relationship between Number of Upgraded Cows and current Income from Milk

Variable	b	Standard error	Beta (Standardized Coefficient)	Zero order Correlation coefficient	Partial correlation coefficient	t
Number of upgraded cows	.215	.163	.110	.105	.109	1.314
Age	.065	.069	.079	-.084	-.051	.941
Gender *Male (1) vs Female (0)*	-.108	.176	-.054	-.084	-.051	-.615
Farm size	-.053	.098	-.045	-.028	-.045	-.543
Marital status *Married (1) vs not married (0)*	-.019	.051	-.032	-.061	-.031	-.374
Education level	.022	.066	.028	.029	.028	.334
Constant	2.754	.517				5.323*

R=.163; R^2=.026; df=6; 150; F= .652; p<.05, * significant at .05 level

Farm size did not show significance which could be due to the possibility that respondents with smaller portions of land had options of buying fodder or leasing land to produce enough fodder that would result in increased milk yield hence increased current income from milk. Gender of respondent did not influence current income from milk which could be explained by the fact that both men and women had similar opportunities to increase current income from milk. The LDP progamme also paid special attention to

women bringing them to about the same status as men in dairy cattle production. Marital status did not influence current income from milk since both single and married people were incorporated in the LDP programme and women worked as hard as men. Respondents acknowledged upgrading Zebu cows and adopted it although most of them kept between 1-2 upgraded cows.

In the first objective the respondents were also asked to give their opinion on upgrading of Zebu dairy cows package that they received. Responses were as follows, 71% said the information was useful since it increased milk production, 16% reported the information being exhaustive in breeding, 12% reported gaining skills to apply information on upgrading that was availed to them. About 71% of the respondents reported increased milk production in Zebu dairy cows during LDP implementation. The number of respondents who got more than 4 litres of milk increased. For instance, respondents who got 4-5 litres increased from 14 to 51 and those who got 5-8 litres increased from 7 to 28. The respondents who got 1-2 litres reduced from 62 to 13 and those who got 3-4 litres also reduced from 68 to 58. Respondents also reported increase in the amount of milk consumed at home as a result of upgrading their Zebu cows. For example 61% reported retaining 1 litre of milk per day for home use after sales which was a change from what they had before LDP. At the same time the respondents still indicated that they kept some indigenous Zebu cows for other reasons than milk production. They expressed that they kept none-upgraded Zebu for purposes such as dowry payment and funeral ceremonies.

Sixteen percent reported having been taken through animal breeding skills that enhanced early detection of animal diseases and heat signs. The breeding skills passed to the respondents also enabled them to improve on management levels of their animals. This implied that respondents accepted and acknowledged the importance of upgrading their Zebu dairy cows. This resulted in increased milk yields and respondents were able to meet their basic needs. Income earned from milk contributed to improved socio-economic status of the respondents; they had a stable income which enabled them to buy household assets like sofa set, radio, bicycles among others. Some respondents improved on their housing structures by putting up semi permanent houses, dairy units besides other basic needs for example paying fees for their children, buying food among others.

These agreed with extension agent from the Department of Livestock Production who reported respondents being able to meet their basic needs. These results agree with a study carried out in South Wollo zone of Amhara State of Ethiopia on milk yields and reproductive performance of 16 indigenous and 16 crossbred cattle kept under smallholder management conditions in which the animals were assessed for five months. Results indicated that daily milk yields at all stages of lactation were significantly higher in upgraded cows than in indigenous cows (Abraha, Belihu, Bekana & Lobago, 2009).

According to the results, moderator variables did not contribute to variance in dependent variables. These findings indicated that LDP package on upgrading had influence on dairy cattle production. Therefore the null hypothesis was rejected and the alternative accepted.

4.4. Relationship between Fodder Production Practices and Dairy Cattle Production

The second objective was to determine relationship between fodder production practices and current dairy production among LDP dairy cattle farmers in Homa Bay and Ndhiwa sub-counties. The information sought from respondents was on implementation of improved methods of fodder production. Through LDP programme respondents were trained on fodder varieties and methods of production. Data was collected on farm size, acreage allocated for fodder during LDP implementation, acreage allocated for fodder after LDP implementation, number of varieties that were introduced by LDP and number of varieties grown currently. The study also gathered data on how frequent respondents applied manure to fodder crops, number of varieties that were grown, whether they grew sufficient fodder and how many kilogrammes of hay and silage were conserved. The researcher sought to know the number of kilos of home-made feeds that were formulated every three months and kilos of napier fed to cows. The number of respondents who allocated less than an acre of land for fodder production increased from 22% during LDP implementation to 30% after programme implementation, while those who allocated one acre decreased from 68% to 54%. This was an indication that although the package on fodder production practices: Production of different varieties, manure application, timely harvesting and weed control were adopted, the acreage allocated for production reduced possibly due reduced land size caused by land segmentation and lack of subsidies in

fodder production. However, those who allocated 2.99-2.99 acres increased from 13 to 21 respondents which was also reported by the extension agents (Table 6).

Table 6. LDP Package on Fodder Production Practices against Current Fodder Production

Fodder Production Practices	During LDP Programme		After LDP Programme	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Acreage allocation for fodder production (acres)				
Less than1	33	21.9	45	29.8
1-1.99	103	68.2	82	54.3
2-2.99	13	8.6	21	13.9
3 and above	2	1.3	3	2.0
Varieties produced				
1-2	59.1	39.1	110	72.8
3-4	72	47.7	36	23.8
Above 4	20	13.2	5	3.3

The results on the number of varieties which were grown indicated that number of respondents who grew 1-2 varieties increased from 59 to 110. Those who grew between 3-4 varieties reduced from 72 to 36 while those who grew above 4 varieties reduced from 20 to 5 respondents. This showed that although many respondents grew fodder, the number of varieties they grew reduced. Possibly sub division of ancestral land by fathers to their sons contributed to this and probably most land was used for other purposes. To improve on fodder quality, respondents were encouraged to apply manure in fodder fields. Majority of respondents (62%) applied manure at an interval of three months as recommended in the LDP package on fodder production and 10% applied after six months. More than half of the respondents (78%) reported planting insufficient fodder for their animals which was contrary to LDP package. This could be due to the fact that most of them allocated one acre of land for fodder production due to reduced acreages owned by specific respondents. This resulted in 74% not conserving fodder into hay and

silage and 80% not formulating feeds at home. Additionally, 29% fed their dairy cows on less than 12 kg of dry matter/animal /day due to lack of enough conserved fodder. However seventeen percent fed 16 kg of dry matter to each dairy cow/day which was the recommendation in the LDP package.

The Second Hypothesis stated that there is no Statistically Significant Relationship between Fodder Production Practices and current Dairy Production among LDP Dairy Farmers in Homa Bay and Ndhiwa Sub-Counties.

The independent variable for the second hypothesis was fodder production practices that were measured by acreage allocated for fodder production and number of varieties of fodder grown currently while the dependent variable was dairy production measured by daily milk yield and current income from milk. Through regression, independent variables and moderator variables were run against each of the dependent variables to determine whether they contributed to variance in dependent variables. The moderator variables were built in the study to find out whether they influenced variance in the dependent variables or it was purely due to the influence by independent variables.

First regression examined the extent to which acreage allocated for fodder production and number of varieties grown currently, age, gender, farm size, marital status and education level explained variance in daily milk yield. The model was statistically significant indicating that there was a relationship between fodder production practices and dairy cattle production ($F=2.373$; $df= 7; 150$; $p<=.05$). The independent variables explained 10.4 % of the variance in the dependent variable. Acreage allocated for fodder production and farm size were significant (Table 7). The significance in acreage allocated for fodder production could be explained by the fact that, fodder availability, sufficiency and good management determined daily milk yield. Number of varieties grown was not significant, may be diversity in fodder production did not influence daily milk yield as long as the quantities and quality of the few varieties that were produced were sufficient for the dairy cows. The negative relationship could probably be due to the fact that the respondents possibly had other ways of making up for lack of variety in their fodder through buying of fodder.

Table 7. Relationship between Acreage Allocated for Fodder Production, Number of Varieties Grown Currently and Daily Milk Yield

Variable	b	Stan-dard error	Beta (Standardiz-ed Coefficient)	Zero order Correlation coefficient	Partial correlation coefficient	t
Acreage allocated for fodder production	.347	.114	.267	.159	.247	3.050*
Number of varieties grown currently	-.166	.144	-.095	-.052	-.091	-1.151
Age	.099	.065	.124	.052	.125	1.508
Gender *Male (1) vs Female (0)*	.051	.165	.027	-.029	.026	.309
Farm size	-.268	.096	-.239	-.152	-.227	-2.790*
Marital status *Married (1) vs not married (0)*	-.009	.047	-.015	.002	-.016	-.186
Education level	.081	.061	.107	.136	.111	1.330
Constant	2.214	.477				4.638*

R=. 323; R^2 .104; df=7; 150; F=2.373; p<.05; * significant at .05 level

Farm size was significant but negative. This showed that respondents allocated less land for fodder production due to reduced land sizes caused by sub-division of ancestral land. The respondents possibly accessed more fodder through leasing land to grow it or buying from neighbours. Leasing land to produce fodder is a common practice for dairy cattle farmers who own small pieces of land. Age, gender and marital status did not influence daily milk yield. This indicated that to increase daily milk yield did not depend on age, gender and marital status. Young, elderly, men, women, single and married had equal

opportunities to increase daily milk yield.

A second regression analysis was run to determine the extent to which acreage allocated for fodder production, number of varieties grown currently, age, gender, farm size, marital status and education level contributed to variance in current income from milk. The analysis indicated that the model was significant indicating a relationship ($F=2.209$; $df=7; 150$; $p <.05$) and accounted for 9.8 % of the variance in current income from milk. Acreage allocated for fodder production and the number of varieties grown currently was significant. This could be explained by the fact that when more land was allocated for fodder production and well managed, milk yield increased which in turn contributed to high current income from milk. Number of varieties of fodder grown currently was significant and this could be explained by the fact that planting different varieties enhanced availability of different nutrients needed by animals for better health which would translate in increased milk yield hence high current income from milk. The negative relationship showed that the number of respondents who grew more than 2 fodder varieties were fewer than it was expected. Explanation could be that respondents were able to buy what they did not produce or lease land and produced them. Farm size had a negative and insignificant relationship. The reason could be that respondents who had reduced or big pieces of land had equal opportunities to increase current income from milk. Respondents with less land had other ways of increasing current income from milk which was not related to their land for example buying fodder, leasing land for fodder production and using mineral supplements that increased milk yields which reflected in high income from milk. It also indicated that respondents who grew many varieties of fodder were fewer than it was expected and they ensured that the few varieties they grew provided enough feed for the dairy animals despite lacking in variety. Age, gender, farm size, marital status and education level were not significant. This could be because respondents of all ages, men, women, married, single, educated and none educated had similar opportunities to increase current income from milk (Table 8).

Table 8. Relationship between Acreage Allocated for Fodder Production, Number of Varieties Grown Currently and Current Income from Milk

Variable	b	Stand-ard error	Beta (Standardi-zed coefficient)	Zero order Correlat-ion Coefficie-nt	Partial correlate-on Coefficie-nt	t
Acreage allocated for fodder	.310	.119	.229	.129	.213	2.606*
Number of varieties grown currently	-.447	.151	-.245	-.216	-.241	-2.965*
Age	.090	.068	.109	.080	.109	1.310
Gender *Male (1) vs Female (0)*	-.013	.173	-.006	-.084	-.006	-.074
Farm size	-.129	.100	-.110	-.107	-.102	-1.287
Marital status *Married (1) vs not married (0)*	-.029	.049	-.050	-.050	-.048	-.602
Education level	.005	.064	.006	.029	.006	.077
Constant	3.038	.500				6.081*

R=.312; R^2=.098; df= 7; 150; F=2.209; p<.05; * significant at .05 level

These findings agree with a study by Infonet (2010) on importance of nutrition that keeps cattle healthy, strong and that running an efficient nutrition programme can also

improve milk production and reproduction performance. The same study indicates that supplementing dairy cows that feed on tropical grasses with lucerne which was one of the fodder crops included in LDP package on fodder production, can raise milk production from 10 -12 to 14 - 15 litres per cow per day. The findings also agree with the study by Tegegne et al. (2010) which showed that conserved hay, agro-industrial by-products and commercial concentrate rations are the major feed resources used by dairy farmers and poor forages contribute to low milk production. Results for the second hypothesis indicated that no moderator variable influenced variance in the dependent variables except farm size. Respondents adopted fodder production practices although number of varieties grown reduced which was also reported by extension agents from Department of Livestock Production. When the null hypothesis was tested results showed that a relationship existed between LDP package on fodder production and current dairy production therefore the null hypothesis was rejected.

4.5: Relationship between Disease Control and Dairy Cattle Production

The third objective was to determine relationship between livestock disease control practices and current dairy cattle production among LDP dairy farmers in Homa Bay and Ndhiwa sub-counties. LDP packages included a package on disease control. The objective therefore aimed at finding out whether respondents managed livestock diseases using skills learnt through LDP programme. It also sought to know the respondents' opinion about information that was passed to them by LDP staff in relation to livestock disease control practices. Some of the skills taught were regularity in spraying, regularity in deworming and mastitis testing. The number of respondents who controlled diseases reduced from 100% to 87%. About 11% of respondents reported controlling some diseases while 2% indicated that they did not control them. The results indicated that respondents adopted the package on disease control practices despite 11% who controlled some of them. This is an indication that the package was adopted and acknowledged by majority of respondents. The slight drop in the practice may have been caused by lack of subsidy after the programme phased out as indicated by extension agents.

The research also looked at disease control routine through spraying. Results indicated that the number of respondents who sprayed weekly increased from 16% to 62%. Those

who sprayed after two weeks reduced from 76% to 27%. About 62% indicated spraying on weekly basis, 1½ weeks was carried out by 7%, 27% followed the spraying routine of 2 weeks while 3% sprayed after 3 weeks. Lack of proper regime in spraying resulted in some of the dairy cattle dying hence the reduced numbers of upgraded dairy cows reported by both respondents and extension agents from the Department of Livestock Production. Disease control through regular deworming (3 months) was practiced by 77% of the respondents, 6% after 4 months, 6% based on availability of funds. According to the research findings, de-hoofing was the least practiced. Majority of the respondents (82%) did not de-hoof their animals when need arose. They reported the practice being tedious and time consuming. Castrating of Zebu bulls was also not practiced by 81% of the respondents yet it was one way of ensuring that Zebu cows were not served by Zebu bulls. Mastitis testing before milking was another component that was addressed in disease control package. Findings indicated that 41% of respondents tested for it once per day, 36 did not do it, 19% tested for it every milking time while 4% carried the test twice per week. Respondents were exposed to two types of spraying: Individual spraying crashes or communal cattle dips. About 42% reported being 3 km away from a cattle dip, 22% were away by 2 km, 21% were more than 3 km, 3% were less than 1 km while 13% were 1½ km. Respondents who were near the dips carried out their dipping routines without much strain as opposed to those who lived farther and did not have individual crashes.

The study sought opinions from respondents on the LDP package on disease control. Thirty two percent reported dairy animals being very healthy during LDP implementation. Thirty percent reported reduction in mortality rate which is supported by 98% of respondents controlling diseases through spraying. Twenty three percent reported reduced disease incidences while 16% of the respondents were able to identify diseases early due to the trainings they went through during LDP implementation (Table 9).

Table 9. LDP Package on Disease Control Practices against Current Disease Control

Disease control practices	During LDP Programme		After LDP Programme	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Adoption of Disease control				
Yes	151	100	131	86.8
No	0	0	3	2
Some of it	0	0	17	11.3
Disease control routine through spraying				
weekly	24	15.9	94	62.3
Once in 1 ½ weeks	3	2	11	7.3
After two weeks	115	76.2	41	27.2
After 2 ½ weeks	8	5.3	1	0.7
After 3 weeks		0.7	4	2.7

The Third Hypothesis stated that there is no Statistically Significant Relationship between Disease Control Practices and current Dairy Production among LDP Farmers in Homa Bay and Ndhiwa Sub-Counties.

To test the hypothesis, independent variable was disease control practices measured by regularity in disease control and adoption of disease control. Moderator variables included age, gender, farm size, marital status and education level while dependent variable dairy production was measured by daily milk yield and current income from milk. The independent and moderator variables were run against each dependent variable. The first regression analysis was applied to establish how regularity in disease control, adoption of disease control, age, gender, farm size, marital status and education level explained variance in daily milk yield. The model was significant indicating presence of relationship between the independent and dependent variables ($F= 1.148$; $df=7,150$; $p <.05$). Independent variables explained 5.3 % of the variance in the dependent variable. None of the variables was significant. Regularity in disease control was not significant possibly there were fewer incidences of diseases hence less control.

The negative relationship indicated that the number of respondents who were regular in disease control reduced. Adoption of disease control did not influence daily milk yield probably due to the fact that controlling diseases in dairy production was a common practice for improved yields and factors like good quality fodder, availability of water and improved management besides disease control were required for increased milk yields (Table10).

Table 10. Relationship between Regularity in Disease Control, Adoption of Disease Control and Daily Milk Yield.

Variable	b	Standa-rd error	Beta (Standardized Coefficient)	Zero order Correlation coefficient	Partial correlation coefficient	t
Regularity in disease control	-.086	.072	-.105	-.126	-.099	-1.196
Adoption of Disease control	.034	.124	.023	-.011	.023	.270
Age	.062	.066	.078	.078	.077	.941
Farm size	-.147	.094	-.131	.039	-.152	-1.565
Gender *Male (1) vs Female (0*)	.008	.167	.004	-.029	.004	.046
Marital status *Married (1) Not married (0)*	-.004	.048	.007	.091	.002	-.082
Education level	.092	.063	.039	-.152	-.130	1.453
Constant	2.641	.463				5.702*

R= .231; R^2= .053; df=7; 150; F=.1.148; p<.05; * significant at .05 level

The negative relationship indicated that probably daily milk yield did not depend on disease control. Age did not show significance when analysis was run. This indicated that, respondents of different ages had same opportunities to control diseases. Farm size was not significant. This could be because respondents with bigger or smaller pieces of land had equal opportunities to control diseases hence contributing to increased daily milk yield. The negative relationship showed that respondents allocated less land to dairy production and had other ways of accessing fodder for example buying it. Gender, education level and marital status did not contribute to variance in dairy production. This could be because young, middle aged, men, women, single, married, educated and non-educated had similar chances to increase their daily milk yield.

Second regression analysis was run to establish how independent variable measured by regularity in disease control, adoption of disease control and moderator variables: Gender, farm size, marital status and education level explained the variance in dependent variable measured by current income from milk. The model was significant ($F=.2.811$; $df=2,150$; $p <.05$) and accounted for 12.1 % of the variance in the dependent variable, current income from milk. Regularity in disease control and adoption of disease control were significant.

Regularity in disease control contributed to current income from milk. This could be due to the fact that when diseases were controlled regularly, incidences of dairy animals falling sick were reduced resulting in healthy productive animals hence high current income from milk. The relationship was negative which possibly indicated that the number of respondents who controlled diseases regularly reduced. Over dependency on subsidies from the programme contributed to the reduced number of respondents who controlled diseases regularly as reported by both respondents and extension agents from the Department of Livestock production. When adoption of disease control was run against current income from milk, the independent variable was also significant although negative. This might have been contributed by the fact that when diseases were controlled, animals were healthy and resulted in high yields that translated in increased current income from milk. There were fewer respondents who adopted disease control practices than it was expected hence the negative significance.

Age, gender, farm size, marital status and education level were not significant. This could be because men, women, young, middle aged, single and married, educated and none educated had equal opportunities to improve on current income from milk. Farm size was not significant and this could be explained that respondents who had bigger or smaller pieces of land had equal opportunities to control diseases and increase current income from milk (Table 11).

Table 11. Relationship between Regularity in Disease Control, Adoption of Disease Control and Current Income from Milk

Variable	b	Standard error	Beta (Standardized Error coefficient)	Zero order Correlation coefficient	Partial correlation Coefficient	t
Regularity in disease control	-.157	.072	-.183	-.245	-.179	-2.171*
Adoption of Disease control	-.334	.125	-222	-.280	-.219	-2.678*
Age	.068	.066	.083	.080	.086	1.035
Farm size	.017	.094	.014	-.028	.015	.176
Gender *Male (1) vs Female (0)*	-.097	.168	-.044	-.084	-.048	-.527
Marital status *Married (1)vs Not married* (0)	-.025	.048	-.044	-.061	-.044	-.527
Education level	.020	.063	.026	.029	.027	.320
Constant	3.573	,465				7.678*

R= .348; R^2=.121; df= 7; 150; F= .2.811; p<.05; * significant at .05 level

They may have also allocated less land for fodder production but had other ways of increasing current income from milk not related to land for example buying napier grass

or leasing land to produce fodder for their dairy animals. Educated and non educated had similar opportunities to improve on current income from milk.

These findings agree with a report by Ministry of Livestock Development (2006) which indicated that productivity and profitability of dairy production in Kenya depended on effective disease control. which was also supported by Erdem, Atasever and Kul (2010), who stated that obtaining high quality and quantity of milk from dairy enterprises was the main target for dairy industry in many countries hence the need for disease control. According to Oliver et al. (2010), mastitis reduces milk yield and alters quality through influence of severe inflammatory response caused by the infection. Cows suffering from mastitis produce little and contaminated milk.

Disease control was one of LDP's objectives and it focused on controlling diseases in dairy cattle among dairy farmers in Homa Bay and Ndhiwa sub-counties. Disease control was expected to enhance health status of dairy cattle which would contribute to an increase in number of dairy animals and milk yields thereby elevating economic status of the farmers. When data analysis was done to test for null hypothesis, findings indicated that LDP package on disease control practices contributed to variance in dairy cattle production because all models were significant. Since disease control contributed to the variance in dependent variable, the null hypothesis was rejected.

CHAPTER FIVE
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter covers a summary of the study and highlights findings in the study. Conclusion and recommendations of the study are also covered.

5.2. Summary

In objective one the study sought to determine extent of relationship between upgrading Zebu dairy cows and current dairy cattle production among LDP dairy farmers in Homa Bay and Ndhiwa sub-counties. The objective aimed at finding out whether the respondents were upgrading their Zebu dairy cows which was an LDP package. Hypothesis stated that there is no statistically significant relationship between upgrading of Zebu dairy cows and current dairy cattle production among LDP dairy cattle farmers in Homa Bay and Ndhiwa sub-counties. The findings showed that number of upgraded Zebu cows was significant in analysis done. This was an indication that upgrading Zebu dairy cows contributed to variance in current dairy cattle production and respondents adopted the technology which resulted in increased milk yields that improved socio economic status of respondents.

Objective two determined the extent of relationship between fodder production practices and current dairy cattle production among LDP dairy cattle farmers in Homa Bay and Ndhiwa sub-counties. This objective focused on implementation of improved methods of fodder production in which respondents were trained on fodder varieties and methods of production. A hypothesis for objective stated that there is no statistically significant relationship between fodder production practices and current dairy cattle production among LDP dairy cattle farmers in Homa Bay and Ndhiwa sub-counties. Findings of the study showed that acreage allocated for fodder production and farm size was significant which implied that the package on fodder production practices contributed to variance in dairy cattle production. It also indicated that respondents adopted the practice which contributed to high milk yields. An increase in output from dairy cattle production improved enabling them to meet their basic needs. Objective three sought to determine the extent of relationship between livestock disease control practices package and current

dairy cattle production among LDP dairy cattle farmers in Homa Bay and Ndhiwa sub-counties. It aimed at finding out whether respondents managed livestock diseases using skills learnt through LDP programme. Its hypothesis stated that there is no statistically significant relationship between disease control practices and current dairy cattle production among LDP farmers in Homa Bay and Ndhiwa sub-counties. Findings indicated that regularity in disease control and adoption of disease control practices were significant. This implied that LDP package on disease control practices contributed to current dairy cattle production. It also showed that respondents adopted the package which resulted in healthy dairy cows with increased productivity hence improved socio-economic status of respondents.

5.3 Conclusion

Following the significant relationship between independent variable (number of upgraded cows) run against dependent variables (daily milk yield and current income from milk), it can be concluded that respondents implemented the LDP package on upgrading of Zebu dairy cows that they were trained on by LDP programme.

There was a significant relationship between the independent variable (acreage allocated for fodder production) run against dependent variables (daily milk yield and current income from milk). This was an indication that respondents still implemented some of the skills passed to them during trainings on fodder establishment. A conclusion reached was that respondents adopted fodder production practices.

There was a significant relationship between the dependent variable (regularity of disease control) and dependent variables (daily milk yield and current income from milk), it was concluded that respondents still implemented what was passed to them through LDP trainings on disease control practices although some respondents did not control diseases in time.

The findings indicated that respondents had acknowledged and adopted and sustained the LDP packages that were passed to them during programme implementation. They were still upgrading their dairy cows, there was fodder production and diseases were being controlled which was reflected in improved returns. However the number of upgraded

cows had reduced, fewer number of fodder varieties were being grown and some respondents were not controlling animal diseases on time. These gaps can be attributed to the fact that the programme subsidized upgrading, fodder production and disease control services during implementation. However after the programme was phased out respondents may have had challenges in continuing with the practices in total and adoption slowed down.

5.4 Recommendations

1. According to the research findings, respondents adopted upgrading of Zebu dairy cows but the upgraded Zebu dairy cows were few. Therefore the Department of Livestock Production should re-sensitize respondents on upgrading of Zebu cows so that they can increase the number of upgraded cows and initiate bull schemes since reliable artificial insemination centres are far away from the study area.
2. Results showed that respondents adopted fodder production practices passed to them through trainings although they did not grow many varieties. The Department of Livestock Production and stakeholders should carry out more demonstrations on diversified fodder establishment for better animal nutrition.
3. Findings on disease control package showed that respondents were practicing what they were trained on in disease control although it was also indicated that some respondents were not timely in controlling them. The Department of Livestock Production through Veterinary Department should re-train respondents on disease management and importance of regular treatment routine for higher outputs.
4. Research findings showed that respondents adopted LDP packages on upgrading of Zebu dairy cows, fodder production practices and disease control hence the improved socio-economic status of respondents. Therefore the Department of Livestock development should train respondents on up scaling of upgrading Zebu dairy cows for more returns.

5.5. Recommendation for further Research

LDP programme implemented a component on cooperative development to improve on milk marketing. Since objectives addressed by the programme were many, the cooperative component was not covered in this study. A study should be carried out to determine influence of LDP programme package on dairy cooperatives in Homa Bay and Ndhiwa sub-counties.

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Appendix A: Interview Schedule for LDP Dairy Cattle Farmers in Homa Bay and Ndhiwa Sub-Counties

Date of interview……

Interview schedule no……...

Division……...

Introduction

This study gathered data on the extent of relationship between Livestock Development Programme (LDP) packages and dairy cattle production in Homa Bay and Ndhiwa sub-counties. The programme was implemented from 1991 to 2003. The study found out relationship between LDP packages and current dairy production by examining upgrading of Zebu dairy cows, fodder production practices, disease control practices and socio- economic status of LDP farmers. A report from this study will be used by academicians, policy makers and Government departments. Data provided was kept with high level of confidentiality.

Section A: Demographic and Education Data.

1. Gender?

   (a). Male ☐

   (b). Female ☐

2. Age of the farmer?

   …….

3. Marital status?

   (a). Married ☐

   (b). Single ☐

   (c). Divorced ☐

   (d). Separated ☐

   (e). Widowed ☐

4. Farmer's level of education?

   (a). Not gone to school ☐

   (b). Primary level ☐

   (c). Secondary education ☐

   (d). Tertiary education. ☐

5. How many of your children attended school?

(a). Above 6 ☐

(b). 5-6 ☐

(c). 3-4 ☐

(d). 1-2 ☐

(e). None ☐

6. How many have completed form four?

(a). Above 4 ☐

(b). 3 ☐

(c). 2 ☐

(d). 1 ☐

(e). non ☐

7. How many are formally/informally employed?

(a). none ☐

(b). 1 ☐

(c). 2 ☐

(d). 3 ☐

(e). Above 4 ☐

Section B: Upgrading Zebu Dairy Cows

8. How many Zebu cows did you initially own for milk production?

(a). 1-2 ☐

(b). 3-4 ☐

(c). above 4 ☐

9. Do you still have some Zebu cows that are not upgraded?

(a) Yes ☐

(b). No ☐

10. If yes, what are your reasons for keeping them?

.....

11. If no, what are your reasons for not keeping them?

.....

12. How many upgraded Zebu cows do you currently own?

(a). Once ☐

(b). Twice ☐

(c). Three times ☐

(d). Four times ☐

(e). More than four times ☐

13. How many times did you need to serve cows for the service to hold?

(a). once ☐

(b). Twice ☐

(c). Three times ☐

(d). Four times ☐

(e). More than four times ☐

14. What dairy system of production did you apply during LDP implementation?

(a). Tethering system ☐

(b). Semi-zero grazing system ☐

(c). Zero-grazing system ☐

(d). Free range system ☐

15. What dairy system of production do you apply currently?

(a). Tethering system ☐

(b). Semi-zero grazing system ☐

(c). Zero-grazing system ☐

(d). Free range system ☐

16. What was the milk yield per cow per day during LDP implementation?

(a). 1-2 litres ☐

(b). 3-4 litres ☐

(c). 4-5 litres ☐

(d). 5- 6 litres ☐

17. How much milk do you currently get per cow per day?

(a). 1- 2 litres ☐

(b). 3-4 litres ☐

(c). 4-5 litres ☐

(d). 5- 6 litres ☐

18. How much milk is consumed by your family every day?

(a). ½ litres ☐

(b). 1 litre ☐

(c). 1 ½ litres ☐

(d). 2 ltres ☐

(e). none ☐

19. How many cows in milk do you have?

(a). 1 ☐

(b). 2 cows ☐

(c). 3 cows ☐

(d). 4 cows ☐

(e). Above 4 ☐

20. How many milk records do you keep?

(a). 1 ☐

(b). 2 ☐

(c). 3 ☐

(d). 4 ☐

(e). Above 4 ☐

(f). None ☐

21. What is your opinion about the upgrading information given by the LDP?

……..

Section C: Fodder Production Practices.

22. Farm size?

(a). 2-3 acres ☐

(b). 4-5 acres ☐

(c). Above 5 acres ☐

23. What acreage was allocated fodder production during LDP implementation?

(a). Less than 1 acre ☐

(b). 1- 1.99acres ☐

(c). 2- 2.99 acres ☐

(d). 3 acres and above ☐

24. What acreage is currently allocated the following fodder production?

(a). Less than 1 acre ☐

(b). 1-1.99 acres ☐

(c). 2-2.99 acres ☐

(d). 3 acres and above ☐

25. How many varieties of fodder were introduced by LDP programme?

(a). 1-2 ☐

(b). 3-4 ☐

(c). Above 4☐

26. How frequently did you apply manure to your fodder crops?

(a). After a month ☐

(b). after 2 months ☐

(c). After 3 months ☐

(d). Twice a year☐

(e). Once a year ☐

27. How many types do you currently grow?

(a). 1-2 ☐

(b). 3-4☐

(c). Above 4 ☐

28. Do you produce enough fodder for your animals?

(a) Yes ☐

(b) No ☐

29. How many kilogrammes of hay and silage do you conserve per season?

(a). 1000-3000 kg ☐

(b). 4000-6000 kg ☐

(c). 7000-9000 kg☐

(d). Above 9000kg ☐

(e). None ☐

30. How many kilogrammes of home-made feeds do you formulate every three months?

(a). None ☐

(b). 100-200 kilogrammes☐

(c). 2001-301 kilogrammes ☐

(d). 302- 402 kilogrammes☐

(e).403-503 kilogrammes ☐

(f). 504-604 kilogrammes ☐

(g). Above 605 kilogrammes☐

31. How many kilograms of dry matter do you feed each animal on?

(a). Less than 12 kgs/animal/day☐

(b). 12-16 kgs/animal/day ☐

(c). 16-20kgs /animal/day ☐

SECTION D: Disease Control Practices.

32. Do you practice disease control measures taught by LDP personnel?

(a). Yes ☐

(b). No ☐

(c). Some of it ☐

33. How regularly did you spray your dairy cows during LDP implementation?

(a). Weekly ☐

(b). Once per 1 ½ weeks ☐

(c). After two weeks ☐

(d). After 2 ½ weeks ☐

(e). After three weeks ☐

34. Do you still follow the same spraying regime?

(a). Yes ☐

(b). No ☐

(c). Not fully ☐

35. How regularly do you de-worm your animals?

(a) When funds allow ☐

(b). After 3 months ☐

(c). After 4 months ☐

(d) Others (specify)…….

36. How frequently do you carry out hoof trimming?

(a). Once in a year ☐

(b). Twice in a year ☐

(c). Three time in a year ☐

(d). Four times in a year ☐

(e). I do not do it ☐

37. At what interval do you castrate bulls that are not used for breeding?

(a). Once in a year ☐

(b. Once in two years ☐

(c). Once in three years ☐

(d). Never done ☐

38. After how long do you test for mastitis before starting to milk?

(a). Every milking time ☐

(b). Twice in a week ☐

(c). Once per week ☐

(d). Not done ☐

39. How far were you from a cattle dip?

(a). Less than 1 kilometre ☐

(b) 1 ½ kilmetres ☐

(c). 2 kilometres ☐

(d). 3 kilometres ☐

(e). Above 4 kilometers ☐

40. What is your opinion about information that was given by LDP on disease control practices?. ……

Section E: Socio-economic Status

41. How much income did you earn from milk per cow per day during LDP implementation?

(a). 25-50 shillings ☐

(b). 51-76 shillings ☐

(c). 77-102 shillings ☐

(d). Above 102 shillings ☐

42. How much income do you currently earn from milk per cow per day?

(a). 25-50 shillings ☐

(b). 51-76 shillings ☐

(c). 77-102 shillings ☐

(d). Above 102 shillings ☐

43. How many of your children were you able to pay school fees for during LDP implementation?

(a). Above 6 ☐

(b). 5-6 ☐

(c). 3-4 ☐

(d). 1-2 ☐

(e). None ☐

44. How regularly do you receive technical advice from Livestock Development

staff?

(a). None ☐

(b). Once per month ☐

(c). Twice per month ☐

(d). After 3 months ☐

(e). After 4 months ☐

45. How many of your children are you able to meet their basic needs (food, shelter, health and clothing)?

(a). Above 6 ☐

(b). 5-6 ☐

(c). 3-4 ☐

(d). 1-2 ☐

(e). None ☐

46. How many meals did you eat in a day during LDP implementation?

(a). Three ☐

(b). Two. ☐

(c). One ☐

(d) Above three ☐

47. How many do you currently eat in a day?

(a). Three ☐

(b). Two ☐

(c). One ☐

(d). Above three ☐

48. How much land were you able to put under crop each season through milk income?

(a). 1 acre ☐

(b). 2 acres ☐

(c). 3 acres ☐

(d). 4 acres ☐

(e). Above 5 acres ☐

49. What is your present approximate total income per month?

.....

50. What domestic commitment takes the highest percentage of your income?

(a). Food ☐

(b). Fees ☐

(c). Medication ☐

(d). Entertainment ☐

(e). Others (specify……..

51. Type of house?

(a). Temporary ☐

(b). Semi permanent ☐

(c). Permanent ☐

52. What effect did LDP have on your life before it ended?

.....

53. How much of LDP effects can you still feel?

(a). 1/4 ☐

(b). 1/2 ☐

(c). ¾ ☐

(d). All ☐

(e). None ☐

54. Which one of the following were you able to buy from income earned from milk during LDP implementation; a bicycle, a radio, a sofa set and a television.

.....

Others specify……

55. What opinion do you have on information that was given by LDP on socio-economic status?

……

Thank you for allowing me to interview you and for the data you have availed to me.

Appendix B: **A Questionnaire for Extension Agents in the Department of Livestock Production**

Date of interview……

Interview schedule no……

Division……

Introduction

This study gathered data on extent of relationship between Livestock Development Programme (LDP) packages and dairy cattle production in Homa Bay and Ndhiwa sub-counties. The programme was implemented from 1991 to 2003. The study sought to establish the extent of relationship between LDP packages and current dairy cattle production by examining among LDP dairy cattle farmers. A report from this study will be used by academicians, policy makers and Government departments. Data provided will be kept with high level of confidentiality.

1. Gender

(a). Male ☐

(b). Female ☐

2. When did you start working with the Ministry of Livestock Development?

…….....

3. Did you participate in Livestock Development Programme implementation in Homa Bay and Ndhiwa sub-counties?

(a). Yes ☐

(b). No ☐

4. If yes, for how long?

(a). 1-3 years ☐

(b). 4-6 years ☐

(c). 7-9 years ☐

(d).10-12 years ☐

(e). 13-15 years ☐

5. What activities were dairy farmers trained to carry out by the programme?

……

6. Did milk yields increase during LDP implementation?

(a). Yes ☐

(b). No ☐

7. Do farmers still practice what they were trained on by LDP?

(a). Yes ☐

(b). No ☐

8. If no why?

……

……..

9. Are milk yields still high?

(a). Yes ☐

(b). No ☐

10. If no, why?

.....

.....

11. Are dairy farmers still active in dairy activities as they were during LDP implementation?

(a). Yes ☐

(b). No ☐

12. If no, why?

……

…….

13. What initiatives are put in place by the Department of Livestock Development to ensure that LDP trainings are practiced?

……

14. Which effects did LDP packages have in the community?

.....

……

15. Are the effect still felt?

.....

16.If no, why?

(a). Milk production reduced ☐

(b). Disease control became expensive ☐

(c). Less fodder produced ☐

17. How long did LDP trainings take?

(a). 1 day ☐

(b). 2-3 days ☐

(c). 4-5 days ☐

(d). 2 weeks ☐

18. what is the approximate number of LDP farmers implementing what they were trained on?

(a). Less than ¼☐

(b). ¼ ☐

(c). ½ ☐

(d). ¾ ☐

(e). all of them ☐

19. About how much was a farmer's daily income per day?

(a). Khs. 50 ☐

(b). Khs. 100 ☐

(c). Khs. 150 ☐

(d). Khs. 200☐

20. What is the approximate number of dairy animals did each farmer have?

(a). 1-2 ☐

(b). 3-4 ☐

(c). 5-6 ☐

21. What was the distance between dairy farmer and a bull scheme?

(a) Less than 1kilometre☐

(b). 1 ½ kilometers ☐

(c). 2kilometres☐

(d). 2 1/2kilometres ☐

(e). Above 2 ½ kilometers ☐

22. After how long did most farmers take their animals for dipping?

(a). Weekly☐

(b). After 2 weeks☐

(c). After 3 weeks ☐

(d). After 4 weeks ☐

(e). Above 4 weeks ☐

23. How frequent did farmers provide mineral supplements?

(a). Twice a week ☐

(b). Weekly ☐

(c). After 2 weeks ☐

(d). After 3 weeks ☐

(e). Above 3 weeks ☐

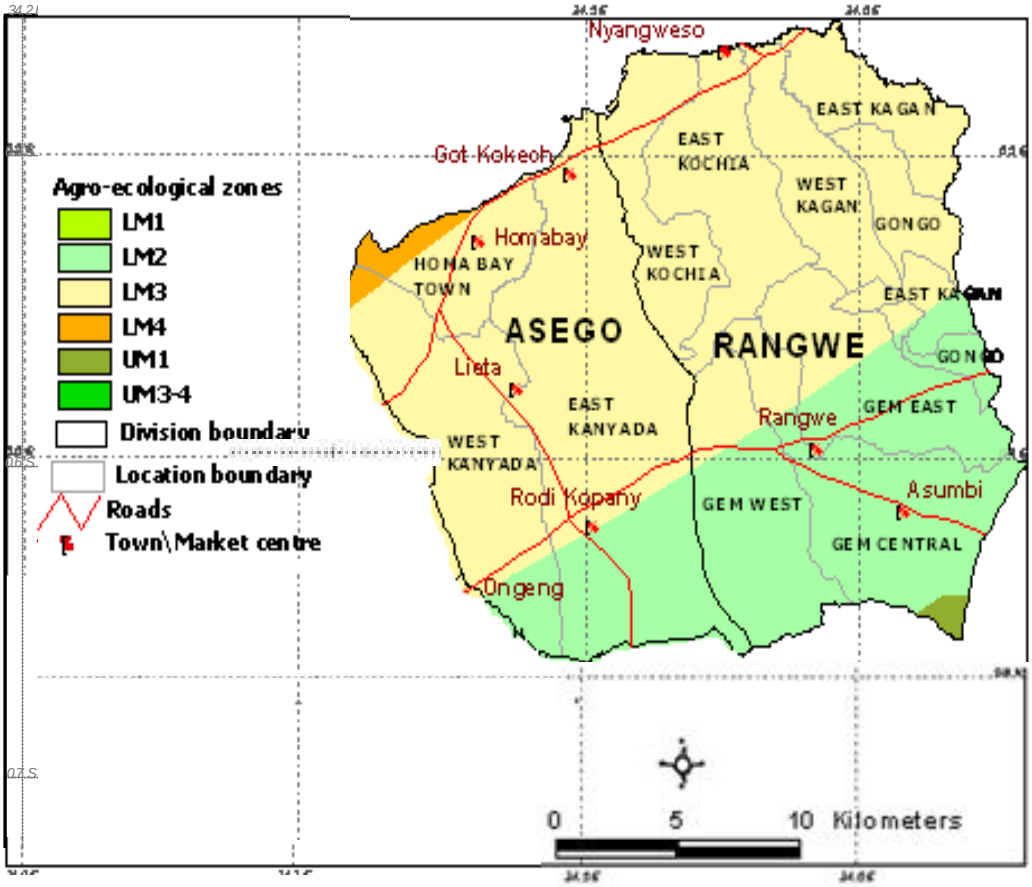
Thank you for allowing me to interview you and for the data you have made available to me.

Appendix C: Former Homa Bay Sub-County Map

Source: Adapted from South Nyanza Community Development Programme

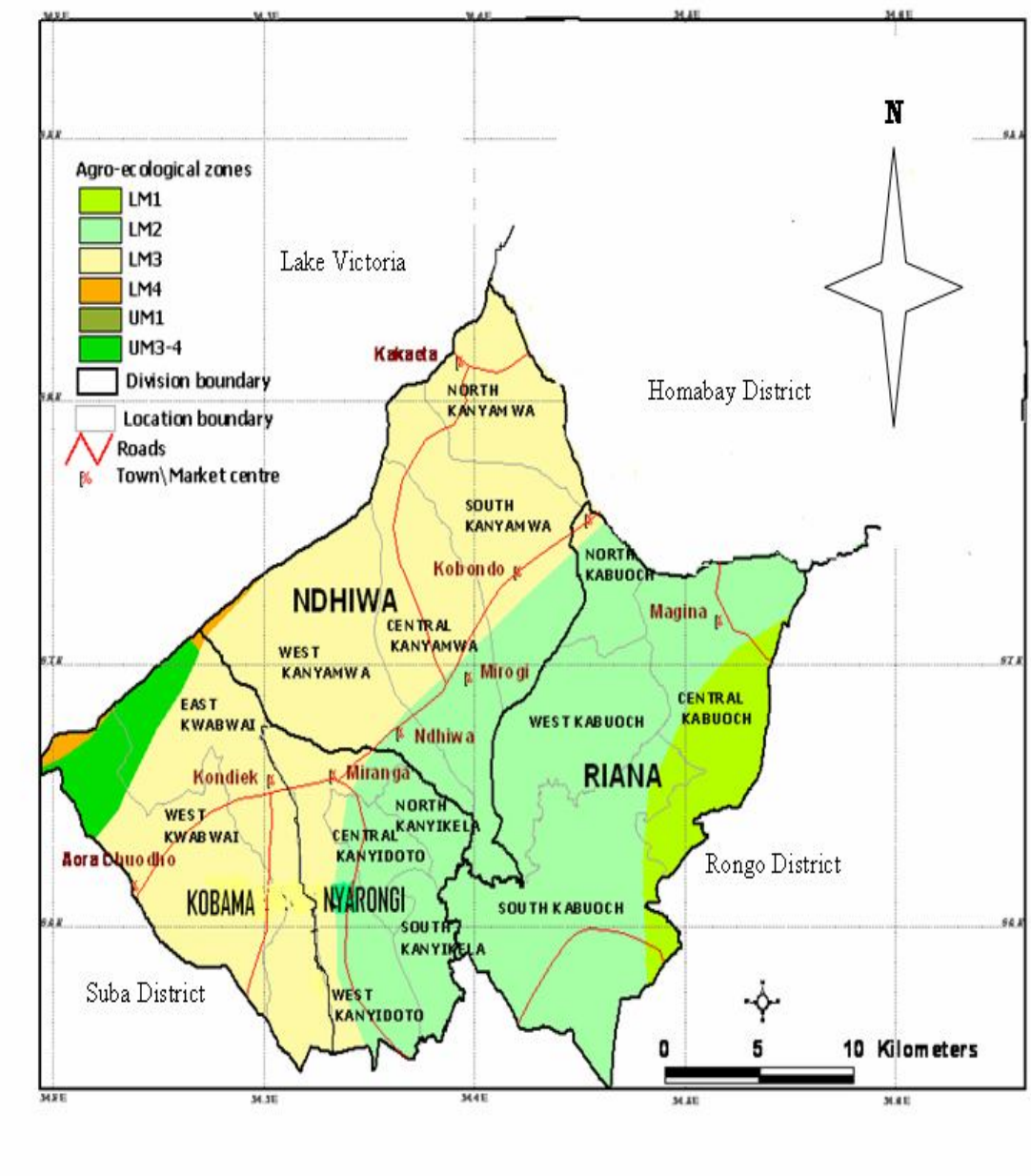
(IFAD Office in Homa Bay Sub-County)

Appendix D: Current Homa Bay Sub-County Map



Source: Adopted from South Nyanza Community Development Programme (IFAD Office in Homa Bay Sub-County)

Appendix E: Ndhiwa Sub-County Map



Source: Adapted from South Nyanza Community Development Programme (IFAD Office in Homa Bay Sub-County)

Appendix F: Research Clearance Permit

CONDITIONS

1. You must report to the District Commissioner and the District Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit
2. Government Officers will not be interviewed with-out prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2)/four(4) bound copies of your final report for Kenyans and non-Kenyans respectively.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice

GPK6055t3mt10/2011

REPUBLIC OF KENYA

RESEARCH CLEARANCE PERMIT

(CONDITIONS–see back page)

PAGE 2

THIS IS TO CERTIFY THAT:
Prof./Dr./Mr./Mrs./Miss/Institution
Catherine Muiwale Athanasa
of (Address) Egerton University
P.O.Box 536-20115, Egerton,
has been permitted to conduct research in

Location
Homa Bay & Ndhiwa
Nyanza

District
Province

on the topic: Relationship between livestock development programme packages and dairy production in Homa Bay and Ndhiwa District, Kenya.

for a period ending: 31st December, 2012

PAGE 3

Research Permit No. NCST/RCD/10/012/28
Date of issue 10th October, 2012
Fee received KSH. 1,000

Applicant's Signature

Secretary
National Council for Science & Technology