1.0 GENERAL INTRODUCTION

1.1 Dairying in Kenya; historical perspective and current status

Kenya has a long tradition in dairy production which was mainly non-commercial milk production from the indigenous cattle (zebu). The commercial dairy industry in Kenya dates back to 1920 when white settlers imported purebred dairy cattle from Europe. The commercial dairy farming developed in two distinct phases. Firstly, large-scale dairying that was on farms operated by Europeans on the Kenyan Highlands and secondly, from the 1950's on African smallholdings. The basis for dairy development in the African smallholder areas was the Swynnerton Plan of 1954 which introduced a number of policy reforms, which included land consolidation and adjudication, cash crop growing, provision of credit and other infrastructural services for dairy development. Since independence, dairying has been transformed into a predominantly smallholder activity in terms of both volume of production and sales. Presently, milk production is integrated with the growing of food crops like maize and beans in a diversified system where the resources of each farming activity are used to benefit the whole system.

The National dairy herd is estimated at 3 million grade cattle and about 10 million Zebu cattle. Dairying in the country is concentrated in the Rift Valley Province with 48% of all the exotic dairy cattle followed by Central Province (31%), Nyanza Province (15%), Eastern Province (5%) and Western Province (4%). The total National milk production is estimated at 1.826 billion litres per year of which 60% is from the dairy herd. It is also reported that there are over 400,000 smallholder dairy farmers having an average of 2 cows each with a farm size less than 2 ha and contributing to over 80% of the total milk marketed in Kenya (MoALDM, 1993).

Of the 1.826 billion litres of milk produced annually, 893 million litres (49% of the total milk produced or 72% of total milk form dairy breeds) is marketed, the remainder being used for home consumption by farm households. This provides per capita annual consumption levels of 125 million litres (urban) and 19 million litres (rural). Despite the large disparity in per capita consumption between urban and rural populations, the absolute numbers of inhabitants results in an almost equal split in total consumption between sectors (49.9% urban versus 50.1% rural).

The government recognizes the role of the dairy industry in the country's economy. It is a source of income and contributes to the improvement of human nutrition through consumption of milk. Dairying contributes to the beef industry through slaughter of culled cows and steers and is a source of employment. The government's policy paper on dairy sector development (Sessional paper No. 4 of 1981 and revised in 1993) has the objectives of maintaining self sufficiency in milk production, increase productivity through measures that facilitate access to appropriate technologies and inputs, and to improve processing and marketing through policies that encourage competition, efficiency and self sustaining systems. There has been a lot of changes since 1992 when the Government set in motion steps towards complete liberalization of the dairy industry. This started with the liberalization of the pricing policy of milk and milk products. Then followed the privatization and reduced Government involvement in Animal breeding (recording, semen distribution, herd books, etc.) and Artificial insemination services; input and veterinary drugs supplies; Animal health care and dipping services; de-regulation of the processing and marketing of milk; and the

rationalization of the Kenya Dairy Board (KDB) which is the body charged with governing the dairy industry.

It is within this liberalized context that efforts are being made to revitalize the sector through increased support to smallholder dairy farmers. This document reviews the smallholder dairy production and milk marketing in Western Kenya (RRC-Kakamega mandate) and provides some general recommendations based on the past and present experiences. During the inception phase of the National Dairy Cattle Research Programme, co-funded by the Netherlands and Kenyan Governments under the National Agricultural Research Project II (July -December 1994), constraints to dairy cattle production and milk marketing in the RRC-Kakamega mandate districts by a team of research and extension officers were identified and prioritized. The constraints experienced by smallholder dairy farmers in the areas comprised;

1 Feed related factors (high prices of good quality feeds and lack of feeds for the dry season, lack of reliable water supply);
2 Animal health factors (diseases e.g. tick borne, worm infestation, F.M.D and high calf mortalities);
3 Socio-economic factors (lack of credit facilities, low milk prices, lack of milk storage facilities especially evening milk, poor infrastructure and small farm sizes);
4 Genetic and animal breeding factors (prolonged service/calving intervals, high cost of quality breeding stock and lack of organized animal breeding programmes and services).

This project however ended in 1999 before most of these constraints had been properly addressed. It is thus envisaged that the Smallholder Dairy Project will try to address these constraints and hence lead to an efficient and sustainable dairy cattle production and milk marketing system within the region to meet the increasing demand for milk and milk products not only for the region but the country as a whole.

1.2 Description of RRC-Kakamega mandate region

Districts under the mandate region

The Regional Research Centre - Kakamega has a research mandate in eleven districts which include Kakamega, Bungoma, Busia , Bondo, Butere/Mumias, Lugari, Mt. Elgon, Nandi, Siaya, Teso and Vihiga. The total area under the mandate is 9,810 square kilometres.

The agro - ecological zones over the region range from Upper Highland zone one (UH_1) to Lower Midland zone four (LM_4). The largest part of the area is in the lower midlands zones (Table 1).

Table 1. RRC-Kakamega mandate Agro-ecological Zones (area in sq Km)

District	UH_1	LH_{1-2}	UM_1	UM_{2-3}	UM_4	LM_{1-2}	LM_{3-4}	TOTAL sq km
Bungoma	-	-	87	475	224	621	282	1689
Teso	-	-	-	-	-	346	105	451
Nandi	37	994	314	150	267	164	-	1926
Mt. Elgon	-	187	93	17	-	1	-	298
Vihiga	-	-	368	-	-	40	-	408
Bondo	-	-	-	-	-	10	766	776
Siaya	-	-	-	-	-	945	288	1233
Busia	-	-	-	-	-	581	317	898
Butere/Mumias	-	-	-	-	-	741	-	741
Lugari	-	-	-	-	474	-	-	474
Kakamega	-	5	177	37	109	569	19	916
TOTAL	37	1186	1039	679	1074	4018	1777	9810

The farm sizes vary across the agro-ecological zones. In the lower midland zones the farm sizes are small averaging 2 ha per household. The smallest farm sizes, however, are found in the upper midland zone (UM_1) of Vihiga and Kakamega Districts while the average farm sizes per household are large in Nandi and Mt. Elgon Districts, and also in the settlement areas of Lugari and Tongaren (UM_{3-4}).

Table 2. Rainfall and Key Enterprise Systems (KES) in the mandate region

District	Rainfall (mm/year)	Key Enterprise System (KES)
Nandi	1200-2000	Maize, Beans, Dairy
Kakamega	1800-2400	Maize, Beans, Dairy
Butere/Mumias	1700	Dairy, Sugar cane
Lugari	1400	Maize, Dairy, Beans
Vihiga	1600-2000	Maize, Dairy, Cassava, Beans
Busia	1200-1700	Ground nuts, Finger millet, Cassava, Sweet potato
Teso	1200-1600	Tobacco, Cotton
Bungoma	1600	Sugar cane, Maize, Beans, Dairy
Mt. Elgon	1600-2400	Highland climate favours temperate crops, Dairy
Bondo	900-1200	Cotton
Siaya	1200-1800	Cotton, Finger millet, Cassava

Various production systems exist over the mandate region (Table 2). In the LM_1 - LM_3 zones, mainly in Nandi District, dairying is the major enterprise and is also the main source of income. Dairy is kept in the extensive system, where most animals are grazed both on natural or planted pastures and legumes. Most pastures are paddocked and there is an element of fodder production. In Mumias and Butere Divisions of Butere/Mumias District and Lurambi, Kabras and Navakholo Dvisions of Kakamega district and Nalondo Division of Bungoma district, LM_{1-2} is the main sugarcane zone. Sugar cane is the main enterprise and cash earner in those areas. Tea is the major cash crop in UH_1 and LH_2 zones. The main crop enterprises in zones LH_{1-2} and UM_{1-4} are maize, beans, sweet potatoes and horticultural crops. In the UM_1 - UM_3 of Kakamega, Vihiga and Bungoma Districts, maize (usually inter-cropped with beans) and dairy are the two major enterprises. The cattle are grazed or tethered in paddocks of either natural or planted pastures and forage legumes. Other crop enterprises include

sunflower, tea, coffee, sweet potatoes, bananas and horticultural crops. Dairy under zero - grazing is over the years becoming popular in these Districts.

The lower midland zones 3 and 4 are the areas that do not have any cash crop. Rainfall is low and the crop and livestock productivity are also low. The enterprises are maize, beans, cassava, sorghum, finger millet, groundnuts, sweet potatoes, green grams, Soya beans, a wide variety of exotic and local and indigenous vegetables and fruits. The cattle kept are local zebus that are poorly fed and managed.

Table 3: Agro-Ecology of the mandate region; soil types, total land area and agricultural area in ha.

District	Total land area (ha)	Elev (m asl)	Slope %	% of total	AEZ	% of Total	Soil	% of Total	Total Agric. (ha)	Agricultural area (Ha)		
										Rainfed	**Irrigated**	**Irrigated potential**
Nandi	274,500	1500-3000	0-8 8-25 25-35	32 15 15	LH 1-3 LM 1-4 UH 1 UM 1-4	52 8 2 38	Nitrosols Lixisols Cambisols Ferralsols	37 19 14 12	192,600	192,600		
Kakamega	107,000	1000-2000	0-8 8-25	94 6	LM 1-2 Um 1-3	62 38	Acrisols Cambisols	45 40	55,800	78,838	1,810	11,852
Butere/ Mumias	91,200	1000-1500	0-8 8-25	99 1	LM 1	100	**Acrisols** Luvisols Gleysols	48 18 13	74,100	74,100		
Lugari/ Malara	98,600	1500-2500	0-8 8-25	81 19	LM 2-3 UM 1	26 74	Ferralsols Acrisols Lixisols	32 28 9	84,100	84,100		
Vihiga	52,200	1500-2500	0-8 8-25	56 44	LM 1-2 UM 1	10 90	Cambisols Acrisols Cambisols	45 40 9	40,800	40,800		
Busia	111,900	1000-1500	0-8 8-25	92 8	LM 1-4	100	**Ferralsuls** Gleysols Acrisols Cambisols	26 24 20 18	89,800	84,031	600	5,169
Teso	50,700	100-1500	0-8 8-25	97 3	LM 1-3	100	Acrisols Gleysols	49 42	47,515	45,100	150	2,424
Bungoma	211,000	1500-2500	0-8 8-25 25-35	98 2 <1	LM2-3 UM2	59 41	Acrisols Gleysols Luvisols Ferralsols Cambisols	38 20 17 13 10	134,500	169,400	4,787	10,292
Mt. Elgon	96,400	1500-4000	0-8 8-25 25-35	14 75 11	LH1-2 LM2 TA1-2 UH0-1 UM1-2	23 2 18 36 21	Nitrisols Cambisols Leptosols	67 17 10	96,600	95,421	53	126
Bondo	107,655	1000-1500	0-8 8-25	97 3	LM2-5	100	Acrisols Cambisols Fluvisols Vertisols	46 14 13 12	107,655			
Siaya	151,183	1000-1500	0-8 8-25	97 3	LM1-4 UM1	99 1	Gleysols Cambisols Acrisols	31 28 29	151,183	132,467	3,176	14,540

There is heavy reliance on family labour to carry out farm activities on smallholder farms in the region. It is evident in recent years that a large share of livestock activities is carried out by women, and this is mainly attributed to three factors. Firstly, animal care traditionally was an important male activity, however in recent years, men have increasingly directed their labour towards off-farm wage earning opportunities, leaving women responsible for much of the farm work. Secondly, with the advent of compulsory education, children are now available to help with the care of livestock only in the afternoon, or weekends, and during holidays. Thirdly, the intensification process itself which focuses labour on food crop production and the provision of cut and carry system of feeds to animals in zero or semi - zero grazing systems has brought livestock care more closely into the sphere of women responsibility. The concern should thus be to develop a strong extension programme that would offer training geared to improving smallholder women skills in the feeding and management of dairy cattle.

Land use dynamics

The land tenure system is free hold, with owners having title deeds. There are though few and isolated cases of communal and urban/peri-urban land tenure systems. However, land is continuously being sub divided into uneconomical units by families as grown up sons seek ownership rights. The region has high potential for both crop and livestock production, though, the productivity is low largely due to low use of inputs and extensive cropping leading to over exhausting the soils.

Most farmers in RRC-Kakamega mandate region practice mixed farming with both crops and livestock farming being practiced. Maize is the staple food crop in the region and is grown for both subsistence and commercial purposes. Other food crops include finger millet, sorghum, cassava, rice and sweet potatoes. Horticultural crops like bananas, kales, French beans, onions and tomatoes are also grown. The cash crops in order of importance include sugar cane, tea, coffee, tobacco, sunflower and cotton. Groundnuts and simsim are also grown but on small scale. Livestock especially cattle, poultry, sheep and goats are kept in the region. Others include pigs, donkeys and rabbits. The acreage under pastures in the region is low as most of it is under cash and food crop production, and this has greatly hindered the growth of the livestock industry.

The RRC- Kakamega mandate region has a multi ethnic human population (Table 4). The main inhabitants of Nandi District are the Nandis (A Kalenjin extraction) and a few Luhyas mostly of Maragoli origin, who migrated to the area. Vihiga District is largely inhabited by Luhyas (A Bantu extraction), mostly Maragoli, Banyore and Tiriki sub tribes while Lugari District and parts of Bungoma District (Tongarren Division) is multi ethnic comprising Luhyas, Kalenjins and Kikuyus who migrated and settled in the area after independence.

Table 4: RRC- Kakamega mandate Districts human population figures in '000. (1999 National census report).

Districts	Males	Females	Total
Bondo	112	135	247
Bungoma	426	452	878
Butere/Mumias	227	251	478
Busia	174	197	371
Kakamega	290	315	605
Lugari	106	111	217
Mt. Elgon	62	68	130
Nandi	291	291	582
Teso	82	89	171
Vihiga	233	266	499
Siaya	220	260	480
Total	**2223**	**2435**	**4658**

Mt. Elgon District is largely inhabited by Saboats (A Kalenjin Extraction) and few Bukusus, a Luhya sub tribe while Bukusu and Tachoni Luhya sub tribes inhabits Bungoma District. Luos inhabit Siaya, Bondo and parts of Busia Districts. Isukha, Idhako, Batsotso, Banyala, Kabras, Wanga, Kisa, Marama, Marachi and Wakhayo Luhya sub tribes inhabit parts of Kakamega, Butere/Mumias and Busia districts and Atessos occupy Teso district. (JAETZOLD and SCHMIDT 1982). These ethnic diversities have a bearing on the development and adoption of the dairy cattle production technologies in the region.

2.0 LIVESTOCK PRODUCTION IN THE REGION

2.1 Cattle Production systems, Population and Distribution

RRC-Kakamega mandate area has about 2 million cattle of which 80% are local zebus and 20% improved. Siaya District has the highest number in total cattle followed by Nandi, Kakamega, Bungoma, Busia and lastly Vihiga. This distribution is related to land pressure as a result of human population increases, feed supply and husbandry methods. The high numbers of zebu cattle in the region is also associated with the socio-cultural practices (dowry payment and prestige), including their ability to resist diseases especially tick borne, where the number of cattle per household is more valuable than the quantity and quality of the product (milk).

The cattle production systems in RRC-Kakamega mandate area can be classified broadly as Small scale dairy production system; Small scale dairy/meat production system; Small scale dairy/meat/traction production system; and Large scale dairy production system. Within these production systems, there are three different breeds of cattle namely; Pure breeds (graded cattle), cross breeds and local zebu cattle. These cattle are reared under free grazing/tethering, semi-zero grazing or zero grazing systems and depend on natural pastures/forage, fodder crops and agricultural by-products as their main feed source.

These production systems are distributed across the different agro-ecological zones. Large-scale dairy production is practiced in agro-ecological zone LH_{1-3}, whereas small-scale dairy production is confined to agro-ecological zones LH_{2-3} and UM_{1-4}. Small scale or large scale dairy farmers are not found in agro-ecological zone LM_{1-4} which covers 61% of the total mandate area, whereas small scale dairy/meat and dairy/meat/traction production systems are found across all the agro-ecological zones.

Local zebus are found in all agro-ecological zones within the region except in agro-ecological zone $LH_{1-3.}$ Graded cattle and crosses are largely confined to agro-ecological zone LH_{1-3} that covers 12% of the total mandate area and agro-ecological zone UM_{1-4} that covers 11% of the total mandate area. Agro-ecological zone LM_{1-4} that covers 61% of the total mandate area does not have improved cattle (pure breeds and crosses). This therefore means that 77% of the total mandate area comprises small- scale farmers who keep local zebu cattle and low value crosses across agro-ecological zones UM_{1-4} and LM_{1-4}.

Graded (improved) cattle are mainly found in Nandi District followed by Kakamega, Bungoma, Vihiga, Siaya and lastly Busia. It is also observed that the density of improved cattle in these Districts is 7 animals per km^2 except in Nandi where the density is 115 animals per km^2. This greatly contrasts with densities reported in other Districts across the country such as: Trans Nzoia, 44 animals per km^2 (76% of the total District herd); Uasin Gishu, 86 animals per km^2 (93% of the total District herd); Kiambu, 61 animals per km^2 (87% of the total District herd); Kirinyaga, 45 animals per km^2 (73% of the total District herd); Murang'a, 73 animals per km^2 (95% of the total District herd); and Nyandarua 81 animals per km^2 (96% of the total District herd). It may be necessary at this stage to give some detailed assessment of the situation in some of the Districts under RRC-Kakamega mandate area with high populations of cattle.

Bungoma District

Bungoma borders Mt. Elgon District to the Northwest, Trans Nzoia district to the North, Kakamega District to the East and Southeast, Busia and Teso Districts to the West and Southwest and the Republic of Uganda to the Northwest at Lwakhakha border point. The District lies between latitude 0^0 25.3' North and 0^0 53.2' North and longitude 34^0 21.4' East and 35^0 04' East and covers a total land area of 1689 square kilometres, about 25% of the total area of the province, out of which 1438 square kilometres is arable land and 1,175 square kilometres is under cultivation. Administratively the district is divided into nine Divisions (Nalondo or Central Division, Kanduyi, Chwele, Bumula, Sirisia, Kimilili, Ndivisi, Webuye and Tongaren), 42 Locations and 105 Sub Locations.

Tongaren Division of the District has the highest population of grade cattle with more or less the same population of zebu cattle, though the other Divisions have low and almost comparable populations of grade cattle. This is because of the settlement scheme that had an early start on dairy activities in the Division pre and post independence. Kanduyi, Bumula and Sirisia Divisions have the highest population of zebu cattle as compared to the other divisions (fig. 1) as a result of the socio-cultural roles (dowry payments, prestige, sales for income) these cattle play in the livelihoods of the local communities and the animals' resistance to diseases. The cattle population in the District has been fairly constant over the years with population of zebu cattle being very high as compared to that of grade cattle and crosses being very high (fig. 2). The populations of both grade and zebu are extremely low in