SDP Collaborative Research Report

A Participatory Rapid Appraisal (PRA) of Farming Systems in Western Kenya

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Table of contents

List of Figures

List of Tables

List of Acronyms

ABS	American Breeders Service
ADC	Agricultural development Corporation
AFC	Agricultural Finance Corporation
CAIS	Central artificial insemination Station
DFCS	dairy farmers cooperative societies
ECF	East Coast Fever
FMD	foot and mouth disease
GIS	Geographical Information Systems
GMR	Guaranteed Minimum Returns
HPI	Heifer Project International
ICRAF	International Centre for Research in Agroforestry
ILRI	International Livestock Research Institute
JSC	juice (chewing) sugar cane
KARI	Kenya Agricultural Research Institute
KCC	Kenya Co-operative Creameries
KDB	Kenya Dairy Board
LDP	Livestock development Project
MOARD	Ministry of Agriculture and Rural Development
NDDP	National Dairy Development Programme
PPE	precipitation over potential evapo-transpiration
PRA	Participatory Rural Appraisal
SDP	Smallholder Dairy Research and Development Project
SSC	sugar, sugar cane
TBD	tick-borne diseases

Executive summary

Introduction

In the second phase of the Smallholder Dairy Research and Development Project (SDP), as well as continuing work in central Kenya, attention will be given to Western Kenya where lessons learnt from the Central and Coast regions of Kenya will be applied. Western Kenya shares a number of features that present an opportunity for smallholder dairy research and development. The climate is favourable for dairy production and average farm sizes are declining rapidly due to increasing population pressure.

This study follows a sequential process Geographic Information Systems (GIS) analysis to identify potential sites, participatory rapid appraisals (PRAs) in the selected sites and characterization surveys. Each step informs the design and analysis of next study, building each time a better knowledge and understanding of smallholder agriculture and dairy systems and the constraints and refining the recommendation domains for the pilot interventions to be selected with farmers, market agents, regulators and policy makers.

Objectives

The PRAs were organised in the districts at the sub-location level by the project management together with the farmers and various stakeholders to:

- Appraise the history and development of agricultural production systems
- Identify stakeholders and their interests
- Learn various farming activities from spatial and temporal points of view
- Identify local needs and constraints to the development of dairy farming
- Identify milk market outlets, flow patterns and constraints faced in this area
- Identify service providers and the constraints faced in their trade

Methodology

The PRA studies in Western Kenya were designed to gain information on broad agricultural activities. PRA sites were selected based on features described by the spatial mapping of factors crucial to dairy farming. The main factors were spread of people, cattle, towns and roads. Factors that describe natural dairy potential: rainfall and humidity, altitude, soils and disease risk were also used. To cover as much of the variation in a district, one sub-location was picked from each of the two most dominant clusters.

The research team included staff from ILRI, KARI and the Ministry of Agriculture and Rural Development. At each site the PRAs were held with groups of farmers of different ages and gender. Farmer turnout ranged from 20 to 130 (on average 50). A variety of PRA tools were

used in a flexible and sequential manner, cross-checking at each stage and improving on reliability and participation of the farmers.

Evolution of production systems

The earliest and most distinctive development was adjudication and demarcation of land from communal ownership to individual holdings in the 1960s and 70s resulting in smaller land sizes per household that could not allow the keeping of large numbers of Zebu cattle. With title deeds, credit became accessible and was mostly used for the establishment of the new high yielding maize hybrids, which were also encouraged by effective marketing through the National Cereals Board. During this same period, government supported services were strengthened through the provision of agricultural field extension workers, establishment of veterinary clinics, and construction of communal dips.

Coffee was established as a cash crop in the 1940s, tea from the 1960s and 80s and sugar in the late 70s and only to the Northern districts. Dairy cattle were introduced only in the early 70s through the national AI and purchase of cows from large dairy farms. In many places Kenya Co-operative creameries (KCC) had established dairy co-operatives in the1960s and milk was marketed through these societies well through the 70s.

The 1980s were the beginning of a period of poor fortunes for both crops and livestock. Poor quality seeds, unreliable markets, high production costs and further decline in land sizes reduced crop production. In the 90s the government withdrew support from essential services and initiated their provision through private enterprise. Withdrawal of veterinary services impacted negatively on the growth of grade cattle numbers.

Current production systems

Despite the conspicuous presence of Zebu cattle, crop husbandry dominates agricultural activities in all areas studied except Nandi where grade cattle are more prominent. A typical household has about three to five Zebu cattle and very few cross or grade cattle. The low number of grade animals kept per household and their low productivity is a result of low feed supply, and poor husbandry methods. The prevalence of the Zebus is associated with the cultural practices (dowry payment and prestige) where the number of cattle per household is more valuable than the quantity of milk produced.

Tick borne diseases, especially East Coast Fever, are endemic throughout the area. Prevalence of foot and mouth disease (FMD) and lumpy skin disease is associated with uncontrolled movement of livestock into and out of the districts and the presence of Trypanosomosis to wildlife in the forests.

There are some indications of intensification in all areas with livestock playing an important role as a source of food, income and manure. Most areas produce their own food with much diversification. All areas indicate high market activities with sale of food and cash crops, milk and also for sourcing inputs such as fertilizer and food.

Communities have close relationships between farmers with the ministry of agriculture, churches, self-help groups, tea and coffee factories, and the veterinary department. The communities did not have close relationships with stockists, KARI and the Agricultural Finance Corporation.

Constraints to crop and livestock production

The constraints that were mentioned by most of the 14 farmers' groups are: animal diseases, extension services, animal breeding, roads, crop diseases, cost of inputs, water, land size, capital, marketing, quality of inputs, output prices, soil fertility, human diseases, veterinary services, credit, management of dips and livestock feeds.

Milk marketing

Most marketing is through the informal sector to nearest urban centre. A few farmers' co-operative societies are still operational though beset by management problems and competition from milk hawkers. Constraints to milk marketing include seasonal fluctuations in supply, high cost of capital items, lack of organised marketing, high transportation costs, lack of storage facilities and knowledge on milk handling.

Conclusions

Over time, farmers have been responsive to incentives as shown by rapid increases (decrease) in production of crops and milk when conditions are conducive (not conducive).

Most areas in the region have the potential for intensive livestock production due to favourable climatic conditions. Intensification of dairy production would increase the household labour demand and offer alternative sources of income.

Western and Nyanza are generally deficient in milk and flows tend towards the major towns. There are opportunities for growth in milk marketing if there's improvement in the organization of traders and encouragement by regulatory bodies to trade in larger volumes under hygienic conditions.

For SDP, the issues that will have to be addressed will revolve around the huge milk deficit while there is still potential to increase milk production. Immediate issues would be to

improve our understanding on why the production gap exists and why farmers do not adopt technologies that would increase milk output.

1 INTRODUCTION

In the second phase of the Smallholder Dairy Research and Development Project (SDP), as well as continuing work in central Kenya, attention will be given to Western Kenya where lessons learnt from the Central and Coast regions of Kenya will be applied. Western Kenya shares a number of features that present an opportunity for smallholder dairy research and development using results of studies that have been done in the other regions. The climate is favourable for dairy production and average farm sizes are declining rapidly due to increasing population pressure.

The sequential process to be followed is the national rapid appraisal with its broad description and diagnosis of western Kenya. This will include subsequent sub-regional reviews for each of the mandate areas under Regional Research Centers (RRC) of the Kenya Agricultural Research Institute (KARI), Geographic Information Systems (GIS) analysis to identify potential sites, participatory rapid appraisals (PRAs) in the selected sites and finally the characterization surveys. Each step informs the design and analysis of next study, building each time a better knowledge and understanding of smallholder agriculture and dairy systems and the constraints to, and opportunities for, their improvement, and refining the recommendation domains for the pilot interventions to be selected with our clients: the producers, the market agents, the regulators and the policy makers.

These studies of a new area attempt to get a clear picture of the prevailing production systems and in particular the dairy industry and how they have evolved over time. Milk marketing structure is also appraised since it has been learnt from the previous studies that the development of commercial small-scale dairy industry is a function of milk demand and the product delivery systems. Moreover, the very recent but fast changes in milk marketing as a consequence of a liberalised economy have created opportunities for growth in dairy production and milk outlets that have not been adequately studied in these parts of the country.

The initial diagnostic surveys of Western Kenya are expected to provide an avenue through which the current status of the dairy industry can be observed and provide a guide for project entry and implementation. These surveys include spatial analysis of secondary data to target site selection, rapid appraisals and farm characterisation studies that will form a major part of the first months of the project's second phase.

1.1 Objectives

The PRAs were organised in the districts at the sub-locational level by the project management together with the farmers and various stakeholders to:

- Appraise the history and development of agricultural production systems (and in particularly the dairy industry) to the state in which they are today
- Identify stakeholders and their interests
- Learn various farming activities from spatial and temporal points of view
- Identify local needs and constraints to the development of dairy farming
- Identify the various milk market outlets and flow patterns while studying constraints faced in providing this essential link between producers and consumers
- Identify various other service providers and learn the constraints faced in their product delivery

1.2 Methodology

The PRA studies in Western Kenya were designed to gain information on broad agricultural activities and dairy farming set-up. A team of researchers and extension workers met with farmers to discuss the evolution of agricultural production systems, movement of resources, services and general constraints. PRA sites were selected based on features described by the spatial mapping of factors crucial to dairy farming. Gaining preliminary insight into both Western and Nyanza Provinces was initiated by secondary data analysis, which served two goals. In the first place, mapping the spread of people, cattle, towns and roads (Annex 1) provides a very general overview of the kind of areas the study will be dealing with. It also provides an initial attempt at targeting research areas with certain characteristics. To identify specific and promising cattle or dairy areas, the relationship between cattle and spatial indicators were used to map differentiation in dairy potential to focus site selection.

1.2.1 Site selection

Earlier studies show that a number of factors strongly influence the production and marketing of milk by smallholders. Apart from the individual household characteristics these are human population growth and densities, climate and rainfall and access to urban centers and services (Kiambu Pilot Survey 1997).

Population growth and densities retain a dual relationship with dairy, presenting a market and price incentive for intensified production when numbers are high. At the same time, however, pressure on land and resources may leave farmers with little other choice but to intensify, if they have the means. Closely related to population density is dairy market access. Both the Kiambu study and the Other District Survey (1998) show that more intensified systems are

mainly found in highly populated areas and close to urban centers, which provide market outlets and good milk prices that act as an incentive to produce. Since the timing of milk delivery and collection is critical, particularly in a smallholder African setting where cooling systems are rarely available, distance to markets and available infrastructure are of prime importance to smallholder farmers. Of course, infrastructure and distances do not only influence market access, they also affect the availability of veterinary and artificial and insemination services. Hence, general accessibility is an important factor where dairy is concerned.

Apart from factors related to market access and infrastructure, factors that describe natural dairy potential are rainfall and humidity, altitude, soils and disease risk. Given the use of crossbred animals and associated susceptibility of imported breeds, disease challenge plays an important role in farmer choice of production systems. Tick-borne diseases present a serious threat to the whole dairy system as a number of them cause heavy mortality losses (Staal et.al. 1999).

However, due to data limitations, only those factors for which GIS coverages could be made available within a reasonable time span were used in the initial stratification procedure. These turned out to be mean household density and climatic potential per sub location and mean access to the nearest urban center:

- Population data were derived from the 1989 census. Since the survey will focus on households and their practices, household densities have been given preference over population densities as an input for patterns of spatial differentiation.

- Annual PPE (precipitation over potential evapo-transpiration) proved to be a useful indicator for climate related factors. It combines elevation, rainfall and temperature data into one measure of overall humidity. A PPE value of 1 indicates that the amount of rain falling is similar to the amount lost through evapo-transpiration (crop production can only be carried out when PPE is greater than 0.5)

- The layer for access to urban centers was created by ICRAF and estimates the travel time to the nearest urban center (with population density greater than 2,500 persons per square kilometre) in hours.

A major setback was that this layer for access to urban centers proved to be insignificant in almost all analyses tried. The layer is quite crude and does not take into account that different areas are serviced by different road types (and thus show tremendous variations in travel

time). However it proved to be quite useful for a general insight into distance to markets and spatial spread of densely populated areas.

Mapping spatial differentiation

To facilitate sampling in the seven selected districts (Bungoma, Kakamega, Vihiga, Nandi, Rachuonyo, Kisii and Nyamira) the challenge was to come up with groups of sub-locations that ranked similarly on combinations of these dairy related factors. According to Carter 1996, there are two ways in which to create these spatial stratifications. In the first, unique combinations of specific characteristics or value ranges are identified by mapping each factor involved and physically overlaying each map. In the second, statistical models of the relations between variables are constructed which might involve simple correlations, principle component analysis and cluster analysis (Carter 1996). For this characterisation effort we chose cluster analysis. With only three significant data layers available it seemed the most logical thing to do, since both principle component analysis and simple correlations seek to reduce the initial number of variables to serve as input for clustering.

SAS software generated six clusters which portray quite some difference between the various sub-locations. The clusters all range somewhere between the highly urbanized and the remote and sparsely populated (Table 1 and Table 2) Based on these clusters it is possible to voice expectations on the presence and level of dairying, e.g., in sub-locations with high market access, high population densities and resulting low land holdings and a high PPE, chances are considerable that dairy will be present: farmers will be either lured or forced into intensification under these circumstances.

Table 1 Cluster means

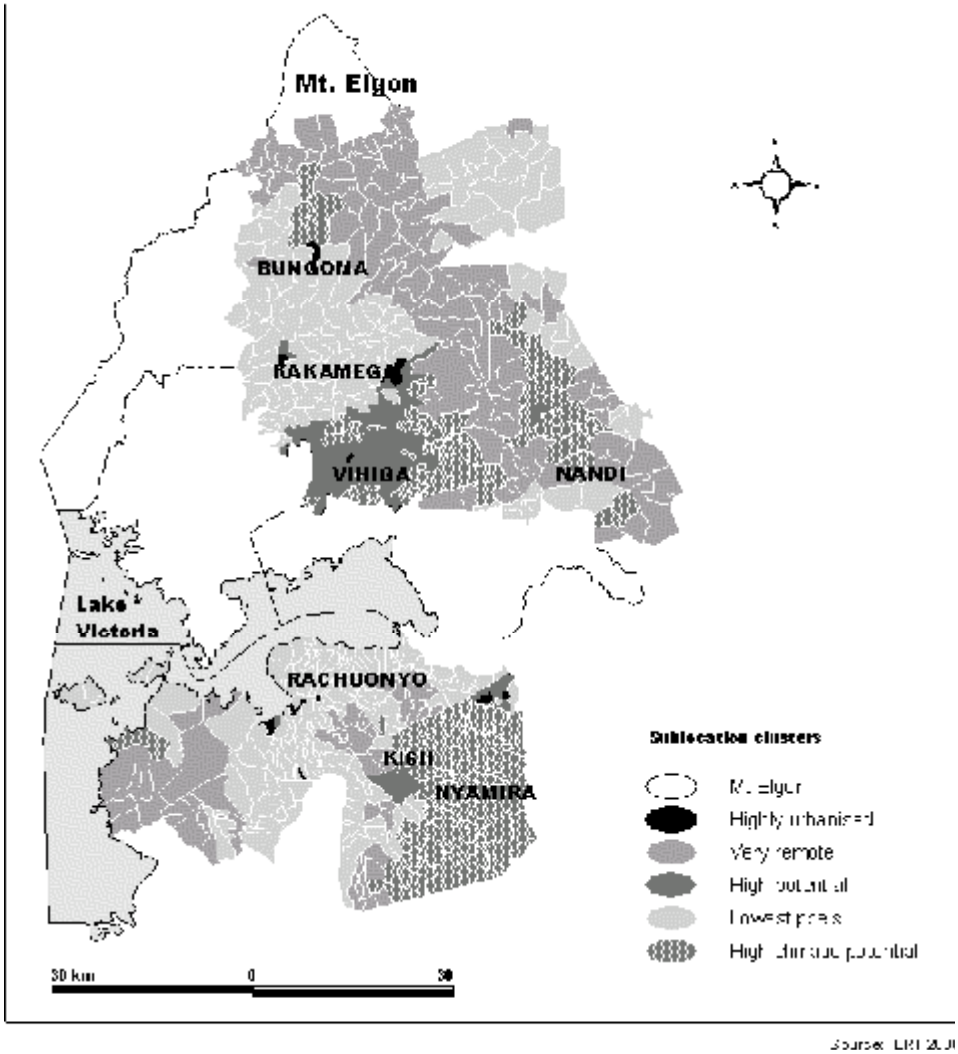
Cluster number.	Mean household density	Mean access	Mean PPE
1 (x1)	0 (low)	5 hrs (poor)	1.07 (high)
2 (x15)	497 (high)	0.2 hrs (high)	0.91 (reasonable)
3 (x155)	53 (low)	2 hrs (poor)	0.95 (reasonable)
4 (x106)	174 (medium)	0.6 hrs (good)	1.07 (high)
5 (x238)	61 (low)	0.8 hrs (reasonable)	0.85 (lower)
6 (x154)	75 (low)	1 hr (reasonable)	1.15 (high)

Table 2 Cluster description

Cluster	Description
1	Mt Elgon
2	Highly urbanised sub-locations (municipalities)
3	Remote, sparsely populated areas
4	High potential areas (not too many households, good access and climatic potential)
5	Lower density areas with good access but lower climatic potential
6	Similar to 5 but with very high climatic potential

To cover as much of the variation in a districts as possible, one sublocation was picked from each of the two most dominant clusters. Thus the PRAs were carried out in Navakholo and Central Kabras in Kakamega, Kilibwoni and Mutwot in Nandi, Nangili and Temberera in Bungoma, Mbihi and Gisambai in Vihiga, Kakelo Dudi and Kojwang Katunde in Rachuonyo, Marani and Suneka in Kisii and Bokiamburi and Ekerenyo in Nyamira.

Figure 1 Clustering of similar sub-locations in western and Nyanza provinces



1.2.2 The participants

The research team included staff from ILRI, KARI and the Ministry of Agriculture. At each site the PRAs were held with farmers from within the area. The farmers were mixed in age, gender even farmers who did not keep livestock. For each site there were 6 to 5 researchers and the farmer turnout ranged from 20 to 130, but on average 50. The farmers gathered at each pre-arranged location from around 10 am and the discussions went on till around 5 pm.

The market PRAs were conducted alongside the farmer PRA. In many places it was not very possible to have the milk marketers gather as a group for an effective PRA and the research team conducted semi-structured interviews. This method was also used for the service providers (veterinary, feed stockists, extension personnel from the Ministry, AI service providers both private and Government employees).
Although the objectives of the study were covered as arranged it was felt that the time allocated was not adequate for an in-depth PRA using all the appropriate tools.

1.2.3 Factors appraised

Diverse PRA tools were to use to gain more insight in:
1. Production systems
2. Condition and circumstances
3. Prioritisation of constraints and opportunities from activities 1 and 2
4. Milk marketing
5. Service provision

For a start, the research team split into two groups and carried out trial PRAs in the two sites in Kakamega districts and compared notes on the outcomes. Later, one group handled Vihiga, Bungoma and Nandi districts and the other Kisii, Nyamira and Rachuonyo districts. The two groups met at the end of each week to review progress and prepare a report on information gathered.

1.2.4 Tools

The PRAs sought to actively involve farmers in appraisal, analysis and prioritisation of local issues. This was done through listening, capturing local knowledge and encouraging partnership. The interviews with farmers were conducted in groups.
A variety of different PRA tools were used in a flexible and sequential manner cross-checking with different methods at each stage to improve on reliability and to involve more people in the planning process.

The actual sequence of methods used in each PRA site broadly followed a similar pattern in each site:

- Time line and trend analysis, to visualise the historical changes in the area: farmers drew on a manila sheet the typical farm in their areas in the 1970s, 80s, 90s and currently. Emphasis was placed in identifying land size, crops grown and their relative areas as well as livestock types and their numbers (Annex 4, Table 3 and Table 4).
- Resource and social map, to identify resources, occupations and means of livelihood: here farmers depicted on manila sheets the flow of inputs into the farm and outputs from the

farm. They would also show movement within the farm between crops and livestock (Annex 2).

- Seasonal analysis, focussing on temporal information pertaining to cropping, land and labour use: using manila paper, farmers would draw the months of a year at the bottom and then indicate with lines or symbols the frequency of occurrence of events for a given crop, e.g., planting, weeding to harvesting. After all crops and livestock were covered a labour profile was drawn depicting monthly requirements through the year (Table 5 and Annex 3).
- Scoring and ranking of constraints and opportunities: based on a list of say constraints that the farmers would give, they were asked to compare two at a time and state which was more severe compared to the other. The number of times a constraint would be repeated formed the scored and these were ranked to show order of importance (Table 6 and Table 8).

Visualisation was used to encourage active participation of farmers in the group interviews.

2 Production Systems

The farmers gave an account of various events that have shaped the current scenarios in the areas (Table 3 and Table 4). The earliest most notable event that has impacted greatly on agricultural systems in this area is the adjudication and demarcation of land from communal ownership to individual holdings with title. This took place in the 60s in most places though it was reported as early as 1957 in Mutwot and as late as 1970 in Kilibwoni, both in Nandi district. This resulted in smaller land sizes per household that could not allow the keeping of large numbers of the local Zebu cattle reported as high as 100 per household in the 60s in Kakamega (west Bunyala), though the average appears to have been 30 to 40, especially for the Southern districts. During this same period, government supported services were strengthened through the provision of agricultural field extension workers, establishment of Veterinary clinics, and construction of communal dips. Credit facilities such as guaranteed minimum returns (GMR) loans were made available through Agricultural Finance Corporation (AFC). These were made possible by the use of land title deeds as collateral. It seems that the credit was mostly used in the establishment of crops, especially the newly introduced high yielding maize hybrids which was encouraged by effective marketing through the National Cereals Board. The high grain yield, taste preference and ease with which maize could be produced and processed resulted in diminishing attention in the production of indigenous sorghum and finger millet especially in the 70s and 80s. However, in Rachuonyo, better hybrids of sorghum (Serena and Seredo) were introduced in 1982 and their production has been on the increase.

Although coffee as a cash crop appears to have been established much earlier than 1960 (in Marani, farmers mention the existence of their co-operative society in 1940), tea was only introduced in Nandi (Kilibwoni) in 1961 and in Rachuonyo as late as 1980. Sugar, sugarcane (SSC) only came in the late 1970s and only to the Northern districts of Kakamega and Bungoma. These crops competed for land other crops and with livestock putting pressure on large local zebu cattle sheep and goat populations and indirectly encouraging the build up of grade cows. Dairy cattle were introduced only in the early 70s through the national AI and purchase of cows from larger Agricultural development Corporation (ADC) dairy farms in Kitale. Farmers in Kakamega (west Bunyala) and Rachuonyo obtained Napier grass from Kakamega research station at about the same time. The availability of the Government supported services for livestock helped sustain a relatively high grade cattle population during the 1970s (an average three to four per household then as compared to one to two now). However, grade cattle population in Kakamega and Rachuonyo, suddenly dwindled due to what farmers described as diseases outbreaks and inability to feed them. In a few places Kenya Cooperative creameries (KCC) had established dairy co-operatives in the1960s

and milk was marketed through these societies well through the 70s. However, administrative problems associated with non-payment of loans saw their collapse at the end of this period.

The 1980s were the beginning of a period of poor fortunes for both crops and livestock. In Nandi, armyworm infestations and maize smut seriously affected crop yields. Growing ineffectiveness of government services resulted in dairy cattle populations dropping to almost nil in Rachuonyo. Maize production was also affected by poor quality seeds, unreliable market (cereals board was not purchasing farmers' produce), high production costs and further decline in land sizes. In the 90s the government withdrew support from essential services and initiated their provision through private enterprise. Dips were left to farmer committees, Veterinary and AI services were left in the hands of private providers. The floundering efficiency of this new approach has negatively affected agricultural production and farmers have not yet readjusted to these developments. These changes and the continuing subdivision of farmland have impacted negatively on agricultural.

Table 3 Historical profile of the livestock systems

PERIOD	Event; activity
1960s	• Land adjudication: *Nandi (Mutwot,Kilibwoni), Bungoma, Kakamega (west Bunyala, central Kabras)* • Sahiwals and crosses introduced: *Nandi (Kilibwoni)* • Grade cattle introduced and increased in number till the 80s: *Nandi (Kilibwoni)* • AI started: *Kakamega (central Kabras)* • GMR loans provided for dairy production: *Kakamega (central Kabras)* • Government supported services availed: meat inspection, hides and skins bandas introduced. Dips started: *Vihiga (Gisambai)* • Kakamega and Malava dairy Coops started: *Kakamega (central Kabras)* • Zero-grazing started: *Kakamega (central Kabras)*
1970s	• Friesian cattle obtained from Kitale ADC: *Kakamega (west Bunyala)* • Napier grass from Kakamega KARI: *Kakamega (west Bunyala)* • Co-operatives increase: *Vihiga (Gisambai)* • AI started: *Nandi (Kilibwoni)* • Grade cattle introduced but many died from TBDs: *Rachuonyo (west Karachuonyo)* • Dairy production started to drop to the lowest level it is today: *Rachuonyo (west Karachuonyo)* • Kakamega and Malava dairy co-operatives collapsed from unpaid loans • Grade cattle introduced in *Kakamega (central Kabras) and Bungoma* • Introduction of Ayrshire bulls after construction of cattle dips: *Nandi (Kilibwoni)* • GMR loans stopped: *Nandi (Mutwot)*
1980s	• Grade cattle introduced but many died from diseases. Number of grade cattle increased due to availability of government supported AI services and organised milk marketing through KCC: *Nyamira (Nyamira)* • Tea introduced: *Rachuonyo (W/Karachuonyo)* • ECF outbreak affects cattle populations: *Kakamega (west Bunyala)* • Dairy production encouraged through Finland supported Rural Dairy Project: *Rachuonyo (west Karachuonyo)* • AI started: *Bungoma* • Seasonal credit introduced: *Nandi (Mutwot)*