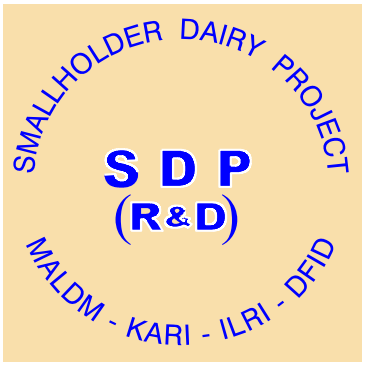
SDP Collaborative Research Report

Characterization of dairy systems in the western Kenya region

Waithaka, M.M., Nyangaga, J.N., Staal, S.J., Wokabi, A.W., Njubi, D., Muriuki, K.G., Njoroge, L.N. and Wanjohi, P.N.

Report of Dairy and Crop Characterisation Activities in Western Kenya
December 2002



Smallholder Dairy (R&D) Project
PO Box 30028
Nairobi, Kenya

Ministry of Agriculture and Rural Development
Kenya Agricultural Research Institute
International Livestock Research Institute
Department for International Development-UK (DFID)

Acknowledgements

Gratitude is expressed to all farmers who participated and contributed to this study. Thanks go the Ministry of Agriculture and Rural Development, KARI and ILRI staff who were tirelessly involved in carrying out and supervising the surveys.

This publication is an output from a research project funded by the United Kingdom Department for International Development (DFID) for the benefit of developing countries. The views expressed here are not necessarily those of DFID

Table of Contents

List of Figures

List of Tables

List of Acronyms

AFC	Agricultural Finance Corporation
DFCS	dairy farmers cooperative societies
ECF	East Coast Fever
FMD	foot and mouth disease
GIS	Geographical Information Systems
HH	household
ICRAF	International Centre for Research in Agroforestry
ILRI	International Livestock Research Institute
KARI	Kenya Agricultural Research Institute
KCC	Kenya Co-operative Creameries
KDB	Kenya Dairy Board
MOARD	Ministry of Agriculture and Rural Development
NDDP	National Dairy Development Programme
PPE	precipitation over potential evapo-transpiration
PRA	Participatory Rural Appraisal
RRC	regional research centre
SDP	Smallholder Dairy Research and Development Project
TBD	tick-borne diseases

Executive summary

Introduction

In the second phase of the Smallholder Dairy Project (SDP), as well as continuing work in central Kenya, attention was given to Western Kenya where lessons learnt from the Central and Coast regions of Kenya would 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.

These characterization surveys follow in the sequential process from Geographic Information Systems (GIS) analysis to identify potential sites and participatory rapid appraisals (PRAs) in the selected sites. Priori to these there were sub-regional reviews. 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. This study was expected to inform the next stages if more in depth studies were required in a particular area.

Objectives

The objectives of the Western Kenya dairy production characterisation survey were to:

- provide baseline data describing the status of the production sub-system;
- learn farmers' objectives and rationale in farming;
- identify and understand factors influencing dairy production, and the constraints and opportunities available to increased production;
- Understand linkages between the production and consumption, processing and marketing systems, and their influences on production;
- Identify recommendation domains for developing policy and technical interventions; and,
- Identify and prioritise researchable issues that, if addressed, will be expected to generate technologies that can impact positively on the dairy system development.

In addition, and as a continuation to the surveys conducted in the other parts of the country (central and the Rift Valley), the exercise was to provide an opportunity to:

- Identify homogeneous groups of smallholder dairy producers in western Kenya based on household and farm resource endowments, production systems and market participation;
- Further test and refine methodologies for the characterisation of dairy production systems, target group identification, and constraint and opportunity analysis to be used in other places with similar set-ups and potential for research and development.

Methodology

The surveys in Western Kenya were designed to gather information on broad agricultural activities. Survey sites were selected based on features described by the spatial mapping of factors crucial to dairy farming. The research team included staff from ILRI, KARI and the Ministry of Agriculture and Rural Development. 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, two sub-locations were picked from each of the two most dominant clusters.

At each site individual household interviews were held. A total of 1,576 households were interviewed using a questionnaire designed and pre-tested by a survey team consisting of MOARD, KARI and ILRI staff.

Results

Most households were agricultural and of those, more than two thirds had cattle. The zebu cattle were more than forty percent while grades were only 13 percent of the households with cattle. This distribution did not change between households with cattle and those without. There was high preference for Zebu cattle contrary to the fact that the agro climatic potential is extremely favourable for grade cattle production and the demand for milk is quite high in the region. Although tethering as the main system of keeping cattle is on the decline, stall-feeding is not very common.

The survey highlights growing importance of dairying as indicated by the prevalence of milking cows and heifers in the herds. The main system of keeping cattle was grazing with some stall-feeding but very little zero grazing was practiced. Grazing was mainly associated with the Zebu while stall-feeding were associated with crosses and grade animals. Cut and carry was common across all animal types whether Zebu or grade. But only less than 16% of the households supplemented their cows with concentrates. About a fifth of the households purchased fodder and stored forage for the dry season. Maize was used as a fodder crop by removing thinnings to reduce the density by the majority of the farmers, but a third also used the extra plants to feed livestock.

The survey shows potential for improving animal productivity through more intensification and utilization of crop livestock interactions. There is room to further improve on the productivity of animals through better forage production and management.

Overall there is need to study factors influencing the predominance of subsistence production and less of market orientation and specialization.

1 INTRODUCTION

In the second phase of the Smallholder Dairy Research and Development Project (SDP), as well as continuing work in central Kenya, attention was given to Western Kenya where lessons learnt from the Central and Coast regions of Kenya would be applied. Western Kenya shared 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 was review of the national rapid appraisal, with its broad description, and diagnosis of western Kenya. This would include subsequent sub-regional reviews for each of the mandate areas under the Kakamega and Kisii Regional Research Centres (RRC) of the Kenya Agricultural Research Institute (KARI) (Mudavadi et al, 2001, and Ojowi et al 2001), Geographic Information Systems (GIS) analysis to identify potential sites, participatory rapid appraisals (PRAs) (Waithaka, et al 2000) 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.

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 were 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 forms a major part of the first months of the project's second phase.

Objectives of the survey

The objectives of the Western Kenya dairy production characterisation survey were to:

- provide baseline data describing the status of the production sub-system;
- learn farmers' objectives and rationale, identify and understand factors influencing dairy production, and the constraints and opportunities available to increased production;
- Understand linkages between the production sub-systems and consumption, processing and marketing sub-systems, and their influences on production;
- Identify recommendation domains for developing policy and technical interventions; and,
- Identify and prioritise researchable issues that, if addressed, will be expected to generate technologies that can impact positively on the dairy system development.

In addition, and as a continuation to the surveys conducted in the other parts of the country (central and the Rift Valley), the exercise was to provide an opportunity to:

- Identify homogeneous groups of smallholder dairy producers in western Kenya based on household and farm resource endowments, production systems and market participation;
- Further test and refine the methodologies for the characterisation of dairy production systems, target group identification, and constraint and opportunity analysis to be used in other places with similar set-ups and potential for research and development.

To focus the selection of research sites within the seven districts (Bungoma, Kakamega, Vihiga, Nandi, Rachuonyo, Kisii and Nyamira), cluster analysis was used as a means of spatial stratification. Instead of simply sampling from the entire subset of sub-locations in these districts, clusters of relatively homogeneous areas were created, to serve as a sampling base.

2 SELECTION OF SURVEY SITES

2.1 A spatial analysis of western Kenya dairy systems

Spatial data, coverage on both biophysical as well as socio-economic characteristics of regions, are indispensable to a research framework for two main reasons. In the first place mapping spatial variation can provide a quick and dirty method for assessing a wide area by simply 'eye-balling' differences between dry and wet, accessible and remote, more and less densely populated areas. In addition, when backed up by a conceptual framework, it can support both predictions of the spatial distribution of (agricultural) activities as well as focus selection and prioritising among potential research sites.

The recently greater availability of digital spatial data and user-friendly Geographical Information Systems (GIS) has allowed us to do both for Western Kenya. A diverse set of data layers on population, market access, climate and cattle distributions were available to depict differentiation throughout the districts down to the sub-location level, cluster these data and even try some preliminary predictions for the distribution of dairy cattle in Western Kenya.

2.2 Dairy related data

Data selection for spatial characterisation in Western Kenya was largely based on conceptual relationships between dairy systems and spatial variables established in other studies. Work in Central Kenya, for instance, shows that apart from individual household characteristics, production and marketing of milk by smallholders are strongly influenced by patterns of human population densities, climate, rainfall and access to urban centres and services (Staal et al, 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, of course, if they have the means. Closely related to population density is dairy market access. Both the Kiambu study and the other district survey (Staal et al., 1998) show that more intensified systems are mainly found in highly populated areas and close to urban centres, 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 a most important factor where dairy is concerned.

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

However, not all above-mentioned factors were covered by useful data sets. Therefore, only those features for which GIS coverage could be made available within a reasonable time span were used in the initial stratification procedure. The one major setback was that the only available layer for access to urban centres 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. To deal with the remaining issues, the following comprehensive and relatively recent secondary data were used:

- Population data 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.
- To cover climate related factors, annual precipitation over potential evapo transpiration (PPE) proved to be a useful indicator. It combines elevation, rainfall and temperature data into one measure of overall humidity: a PPE value of one indicates that the amount of rain received is similar to the amount lost through evapo transpiration (for comparison: crop production usually starts at PPE greater than 0.7).
- The available layer for access to urban centres was created by ICRAF and estimates the travel time to the nearest urban centre (with population density greater than 2,500 persons per square km) in hours.
- The Kenya Central Bureau of Statistics provided ethnicity data for all districts at sub-location level.
- Data on tick borne diseases were provided by ILRI-GIS section and supplemented by household data on the occurrence of tick related illnesses from the other district survey. The available layers cover brown ear tick distribution data and expert opinions on the spread of East Coast Fever (ECF) and other tick borne diseases.
- Only recently released by the ILRI-GIS section is a dataset on cattle numbers and densities for each division in Kenya. Data for this coverage were obtained from the Livestock Production Department, which provided the latest district level report on livestock numbers (1992-1998).

2.3 Predicting dairy cattle distribution

A first rather rough attempt at characterisation resulted in a map predicting cattle distribution in Western Kenya, based on a model developed for Central Kenya. The central Kenya model combines weighted values of annual PPE, household density, minimum temperature and market access to produce an index of predicted dairy presence. The weights or relative importance of each of the factors were derived from a logit regression analysis. To map the model outcomes, all spatial data layers were multiplied by their specific weight, summed and converted into a probability index (equation 1)

Predicted probability equation:

$$\text{Index} = -6.799 + 0.0026 * \text{household density} + 0.00092 * \text{access} + 8.316 * \text{annual PPE} + 0.1217 * \text{annual min temperature} \quad (1)$$

PPE proved to be highly correlated with the presence of dairy cattle and was thus strongly weighted in the prediction model. Quite to the contrary, the only available layer of access to urban centres proved to be hardly significant. Hence, the prediction of dairy probability is mainly based on an indicator of climatic potential and population densities and is therefore rather crude. Of course, the crude outcomes (more than 90% probability of running into a dairy cow in all areas of western Kenya) are not merely caused by a limited number of variables, but probably result even more from the assumption that driving factors in central Kenya would similarly determine cattle distribution in the west (Figure 2.1). Which proves to be partly true because although, climatic conditions and market incentives are important driving factors in western Kenya as well, PRA studies conducted in different districts revealed that dairy prevalence was at much lower levels than anticipated, caused mainly by low feed supply during the dry season and poor husbandry methods. In some specific areas like Kakamega, the prevalence of the Zebus is associated with the cultural practices of dowry payment and prestige since the number of cattle per household is more valuable than the quantity and quality of their produce (Waithaka et al., 2000). The fact that our initial predictions were grossly overstated was further confirmed by a recent national coverage on cattle distributions. This too showed that dairy cattle prevalence is meagre in the western districts (Figure 2.). Hence, the probability model could be much improved on, for instance by incorporating data on distribution of different ethnic groups or disease risk.

2.4 Disease risk

Differences in disease risk can certainly be a factor influencing the spread and adoption of dairy cattle, but so far no highly differentiated spatial datasets have been available. Based on the current coverage, all areas of interest in Western turn out equally infected with ticks and tick related diseases (Figure 2.3).