How Smallholder Dairy Systems in Kenya Contribute to Food Security and Poverty Alleviation: results of recent collaborative studies.

H. G. Muriuki[1*], D. M. Mwangi[2] and W. Thorpe[3].

[1]Ministry of Agriculture and Rural Development, PO Box 30028, Nairobi, Kenya.
[2]Kenya Agricultural Research Institute, PO Box 57811, Nairobi, Kenya.
[3]International Livestock Research Institute, PO Box 30709, Nairobi, Kenya.
* author for correspondence

Abstract

Kenya has the largest dairy sub-sector in eastern and southern Africa making available annually an estimated 85-90 litres of liquid milk equivalent *per capita* based primarily upon well-established market-oriented smallholder dairy systems. As a result dairying (the production of milk for the market) has become a very significant source of income and food for an estimated 625,000 smallholder producer households and for those involved in the marketing of milk, in total some 25% of all households. In addition dairying plays a crucial role in sustaining smallholder crop-dairy systems through its contributions to nutrient cycling. It is these smallholder crop-dairy systems, generally based on the cropping of the staple food, maize, that dominate marketed dairy production and that underpin the competitiveness of smallholder dairying in Kenya.

In order to better understand Kenya's dairy sub-sector and to identify constraints to, and opportunities for, improving smallholder dairying's contribution to poverty alleviation and to increased food security, a series of sequential studies have been carried out by the Ministry of Agriculture, the Kenya Agricultural Research Institute and the International Livestock Research Institute through the Smallholder Dairy (R&D) Project, funded by the UK's Department for International Development (DFID). The research has taken a holistic market-oriented production-to-consumption approach with interdisciplinary teams evaluating dairy systems and the interactions of economics, policy, agro-ecology and technology that define their structure. Within the general framework described through an appraisal of the national dairy industry, detailed analyses of the marketing and production systems have identified promising policy, institutional and technological interventions, some of which are being tested. The results of the studies are presented and their implications for poverty alleviation and food security are discussed.

Introduction

In common with their neighbours in Tanzania, the majority of Kenya's people (an estimated 80%) depend on agriculture for their livelihoods and employment. In the same way, agriculture makes a contribution, estimated at over 25%, to Kenya's Gross Domestic Product (GDP), of which livestock contributes about half. Ruminant livestock, for meat and subsistence milk production, are the main economic activity in

the drier parts of Kenya, but dairy production and marketing dominates the livestock contribution to household economies in the rural areas with medium and high potential for agricultural production. It is these smallholder agricultural areas and their crop-dairy systems that support up to three quarters of Kenya's rural population and a large proportion of its ruminant livestock. Not only is dairy the largest livestock sub-sector in Kenya (Muriuki, 2001) but also the *per capita* milk availability it delivers to Kenya's people is one of the highest in sub-Saharan Africa (Muriuki and Thorpe, 2001).

In order to better understand the dairy sub-sector and to identify constraints to, and opportunities for, improving smallholder dairying's contribution to poverty alleviation and to increased food security in Kenya, a series of sequential studies have been carried out by the Ministry of Agriculture and Rural Development (MoARD), the Kenya Agricultural Research Institute (KARI) and the International Livestock Research Institute (ILRI). The development-oriented research has taken a holistic market-oriented production-to-consumption approach with interdisciplinary teams evaluating dairy systems and the interactions of economics, policy, agro-ecology and technology that define their structure. This paper summarizes briefly the results of those studies and highlights their implications for poverty alleviation and food security.

The research process
The series of sequential diagnostic studies was carried out by the MoARD, KARI and ILRI through the Smallholder Dairy Project (SDP), which applied the conceptual framework of an holistic market-oriented production-to-consumption systems approach (Figure 1). The studies sequentially characterised at the national level the dairy sub-sector ("Systems Appraisal") followed by, for the major up-country milk sheds, its four sub-systems: Consumption, Processing, Marketing and Production. These "Sub-system Characterisation" studies (Figure 1) described in quantitative terms the sub-systems, their linkages and interactions, and identified the major constraints to, and opportunities for, dairy development with emphasis on smallholder production and marketing.

This systematic identification of policy, institutional and technical constraints allowed the project and its wide-range of public, NGO and private partners to "Seek Solutions" (Figure 1) to these constraints through targeted development, testing and validation of interventions, a process that is on-going. At the same time the characterisation and diagnostic studies provided considerable insight into the contribution of smallholder dairy systems (and specifically the crop-dairy systems which dominate smallholder agriculture in the Kenya highlands) to food security and poverty alleviation.

The Results and their Implications for Food Security and Poverty Alleviation
As shown in Figure 1, the first stage of the process was an Appraisal of the national dairy sub-sector during which inter-disciplinary and inter-institutional teams evaluated the dairy systems in the major milk sheds of Kenya and the interactions of social, economic and biophysical factors define their structure (Omore et al., 1999).
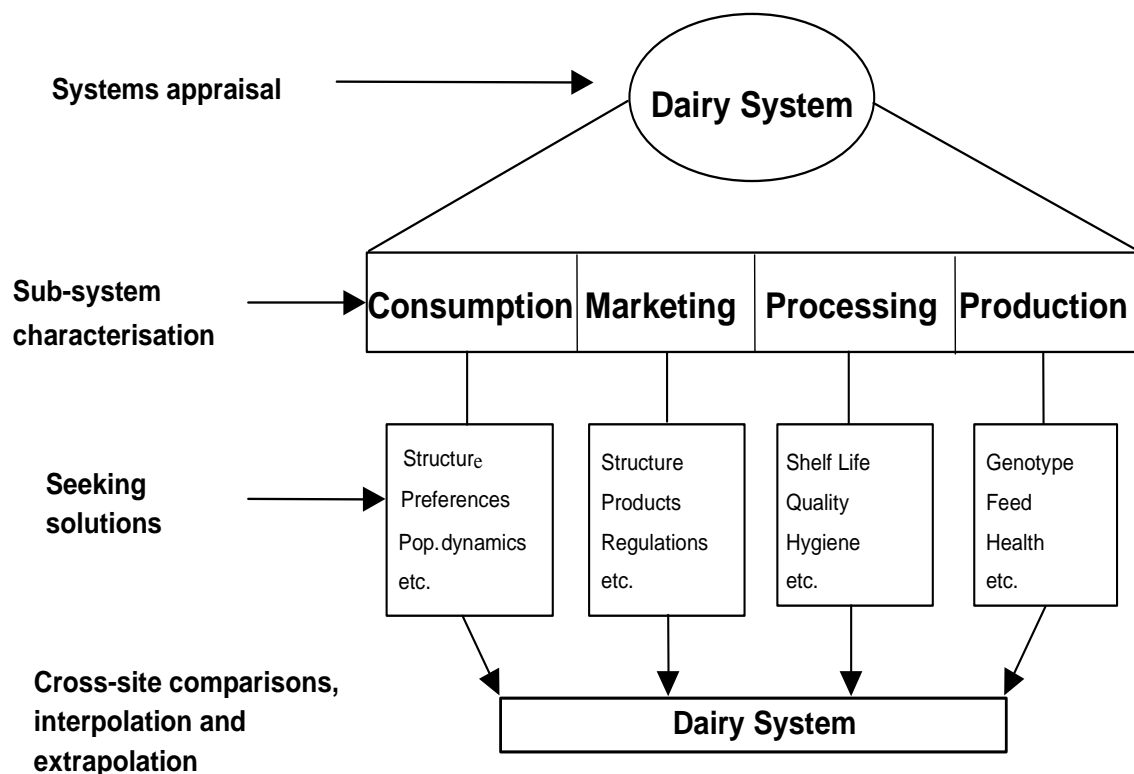
Figure 1. A Framework for Dairy Systems Research and Development
*(*Modified from Rey *et al.,* 1993)

The principal results emerging from the Appraisal (Omore et al., 1999) were that:

- dairy production for the market was concentrated in areas of high and medium cropping potential;
- approximately three quarters of smallholder households practised dairying in the areas of high and medium cropping potential except in the western region where the proportion was significantly lower;
- the large aggregate volumes of marketed milk nationally were made up of small quantities (on average 4-6 litres per household) sold by hundreds of thousands of smallholder households (Figure 2); and,
- the producer households retained on average approx. 2 litres of milk daily for home consumption (about a third of their production).

Smallholder dairying therefore contributes directly (thro' milk consumption) and indirectly (thro' income generation) to both the food security and to alleviating poverty of the majority of smallholders in many areas of Kenya, a contribution coming particularly from the crop-dairy cattle systems that dominate smallholder agriculture.
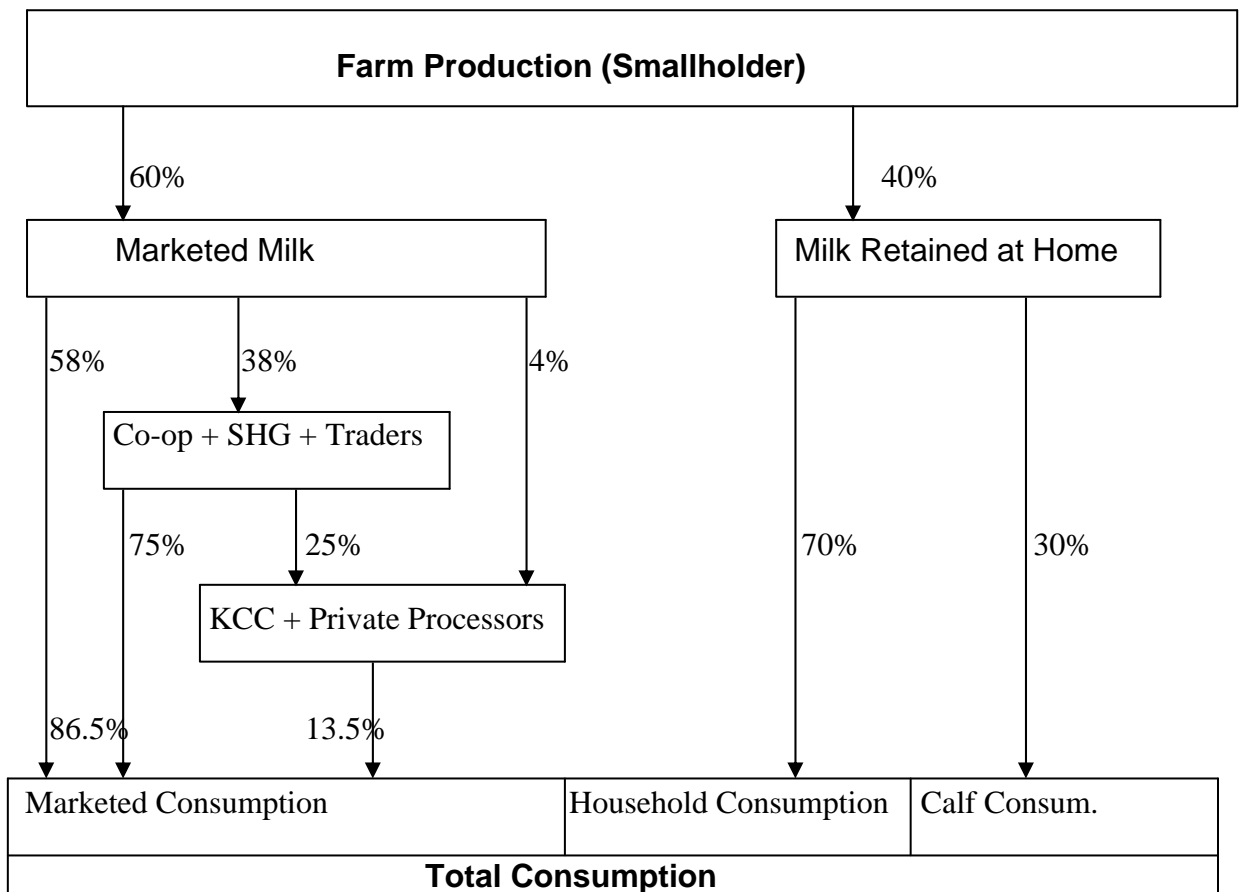
Figure 2: Marketing Channels for Smallholder Milk in Kenya
(Modified from Omore et al., 1999)

The other important outcome from the Appraisal was the realisation that the majority of smallholder dairy producers relied upon the informal milk market (Figure 2). These results have important implications regarding the competitiveness of producer and consumer prices to the advantage of low-income members of both groups, and, in addition, as a source of employment for small-scale market agents (Staal, 2001). These economic efficiencies of small-scale dairy production and marketing are major contributions to poverty alleviation in Kenya, while at the same time ensuring that the high nutritive value of milk (and derived products) is accessible to even the low-income groups of society. Many of these low-income groups could not afford the relatively high cost pasteurised packaged milk produced by the formal marketing system (Ouma et al., 2000).

These marketing and employment aspects of smallholder dairying in Kenya were further quantified thro' the next level of diagnostic studies (Figure 1): the characterisation of the production, marketing/processing and consumption sub-systems of the dairy sub-sector in the up-country regions.

Table 1. Number of jobs created for every 100 litres of milk traded by small-scale dairy marketing and processing in Kenya

Enterprise type	Direct jobs	Indirect jobs	Total
Mobile milk trader	1.7	0.3	2.0
Milk bar	1.1	0.3	1.4
Small processor	0.2	0.1	0.3
Mean	1.0	0.2	1.2

Source: Cheng'ole Mulindo et al. 2001.

These cross-sectional and longitudinal studies confirmed that:

- from the Rift Valley to Mt Kenya, smallholder agriculture sustained over 95% of rural households and of those approx. 75% practised dairying;
- both producer and non-producer households had high levels (relative to neighbouring countries) of milk consumption;
- the informal market (small-scale market agents) was an important outlet for milk sales particularly for the poorest producer groups (Staal et al., 1998), and
- it was an source of employment (Table 1) generating incomes of 2-3 times the minimum daily wage;
- dairy production on smallholdings was a significant source of casual and permanent employment (Table 2); and,
- the marketing of forage was an important source of income (e.g. in 1996 an estimated US$5 million of napier and maize fodder was traded in Kiambu District alone).

Table 2. Number (and percentage) of agricultural households with hired labour, Kiambu District

Dairy Households 261 (77%)			Non-Dairy Households 79 (23%)		
Family labour	**Casual labour**	**Permanent labour**	Family labour	**Casual labour**	**Permanent labour**
77 (30%)	131 (50%)	51 (20%)	42 (53%)	28 (35%)	1 (1%)

Percentages do not sum to 100 because of missing values.

Source: Survey data used by Staal et al., 1998.

The characterisation studies therefore quantified for central and western Kenya, the importance of crop-dairy systems to smallholder food security and their contribution to alleviating poverty. They have documented the high proportion of smallholders who have adopted dairy, particularly in the central highlands and the central Rift Valley, as well as identifying the main factors influencing the adoption of dairying and its component management practises (Staal et al., 1999; 2001).

In addition the studies have shown the key role that adoption of dairying has played in the intensification of smallholder farming systems (Baltenweck et al, 1998). The

intensification has given the increased productivity required by rural households when faced by the sub-division of smallholdings (from land inheritance), while confronting the lack of non-agricultural job opportunities.

Key to the increased productivity of smallholder farming systems in central Kenya were the benefits resulting from crop-dairy interactions. These benefits were in the form of:

- the complementarities of incomes from crops and dairy;
- the provision of fodder for dairy production (in areas of high human population density – increasingly the majority where dairy cattle are kept – the maize crop and weeds and residues from other crops provided nearly half the fodder fed to dairy cattle) (Lukuyu, 2001);
- nutrient flows to the cattle and the availability of their manure to sustain crop production (Utiger, 2000; Lekasi et al., 1998); and,
- the growth of the dairy herd and therefore the accumulation of capital and its liquidity.

These beneficial outcomes of crop x dairy interactions have their basis in the production objectives of smallholders when keeping dairy cattle. Farmers' responses reported in the SDP characterisation surveys have shown that even in these commercially-oriented systems, the primary objective of smallholders adopting dairying is to produce milk for home (household) consumption, followed closely by the objective ranked second, milk produced for sale to generate income (Bebe et al., 2001b).

Underlying and complementary to these objectives is the critical role played by the dairy herd (which is usually no larger than 2 to 3 animals) in enabling resource-poor households to accumulate and, when required, liquidize financial capital. Bebe et al. (2001a) report that the need for cash by households, not poor animal performance (only 10% of sales), was the most frequent reason given by smallholders for the sale of dairy cows (60% of voluntary-exits) and heifers (85% of voluntary-exits). These resource-poor households reported that the cash generated from the sale of a female dairy animal was most frequently used for financing school fees, hospital bills and household investments, indicating the importance of dairy cattle as a means of accumulating fluid capital assets for the households, and the critical role of dairying in alleviating poverty, particularly at times of major stress.

As a result of these detailed analyses of the marketing and production systems and the improved understanding of smallholder dairying, promising policy, institutional and technological interventions have been identified, some of which are being tested. The technical interventions include:

- ways to improve milk hygiene;
- the Lactoperoxidase System (LPS) to length the time for milk to reach market;
- methods such as strategic concentrate feeding and forage production from legumes and the maize crop for increasing milk yields; and,
- improvements to manure management.

The participatory testing of these technical interventions is providing valuable information on how best to improve productivity in these resource-poor systems, thereby addressing the needs of these resource-poor households for improved food security and increased and more stable incomes through the adoption of productivity-enhancing technologies.

In support of these technical interventions and to ensure a more conducive operational environment for landless, marginalized and smallholder households, various policy and institutional interventions are being pursued. These include:

- developing and testing more effective linkages amongst public, NGO and private researchers and extension agents, with emphasis on serving the poorer households in communities;
- testing mass media and public-private partnerships for disseminating technical information;
- targeting information to policy-makers and their advisers on market inefficiencies and institutional constraints to market participation by smallholders, particularly those dependent upon small-scale traders; and,
- targeting information to dairy regulators in support of smallholder dairy production and marketing.

Without concurrently identifying and addressing policy, institutional and technical constraints, it is most unlikely that we will be successful when working with resource poor households, whether smallholders or the landless, in reducing their food insecurity and alleviating their poverty.

Conclusions
By taking a holistic production-to-consumption approach and carrying out systematic analyses of Kenya's dairy sub-sector, the Smallholder Dairy (R&D) Project and the related research has shown that dairying is a very significant source of income and food for an estimated 625,000 smallholder producer households. Many of these farm households would not have been able to sustain their families without the benefits accruing from dairying and its interactions with crop production. In the same way, the employees of the smallholder dairy producers, the input suppliers and those involved in the marketing of milk have benefited significantly from dairying, in total approximately 25% of all households in rural Kenya. Therefore not only has smallholder dairying made a major contribution in Kenya to food security and poverty alleviation, but in the face of the continuing pressure on land and the resultant intensification of land use systems, it is expected to continue to do so for many years to come, particularly if it is given targeted R&D support by efforts like SDP.

References

Baltenweck, I., Staal, S. J., Owango, M., Muriuki, H., Lukuyu, B., Gichungu, G., Kenyanjui, M., Njubi, D., Tanner, J. and Thorpe, W. (1998). Intensification of dairying in the greater Nairobi milk-shed: spatial and household analysis. *Smallholder Dairy (R&D) Project. MoA/KARI/ILRI Collaborative Research Report, ILRI, Nairobi, Kenya.*

Bebe, B. O., Udo, H.M.J. and Thorpe, W. (2001a). Breed preferences and breeding practices in smallholder dairy systems in the central Kenya highlands. *Paper in preparation.*

Bebe, B. O., Udo, H.M.J. and Thorpe, W. (2001b). Cattle population dynamics under increasing intensification in smallholder farming systems in the central Kenya highlands. *Paper in preparation.*

Cheng'ole Mulindo, J. , Omore, A., Fakhrul Islam, S.M., Nurah, G.,. Khan, M. I. and Staal, S.J. (2001). Employment generation through small-scale dairy marketing and processing: experiences from Kenya, Bangladesh and Ghana. *Report for FAO Animal Production Division, Dairy Section (in press).*

Lekasi, J.K., Tanner, J.C., Kimani, S.K. and Harris, P.J.C. (1998). Manure Management in the Kenya Highlands: Practices and Potential. *The Henry Doubleday Research Foundation, 35p.*

Lukuyu, B.A. (2001). The maize crop as a source of food and feed on smallholder farms in the Kenyan highlands. M Phil thesis, University of Greenwich, U.K

Muriuki, H.G. (2001). Kenya Country Paper. In: *Proceedings of the South-South Workshop on Smallholder Dairy Production and Marketing - Constraints and Opportunities*. March 12th - 16th 2001, Anand, India. NDDB/ILRI.

Muriuki, H.G. and Thorpe, W. (2001). Regional Synthesis: Smallholder Dairy Production and Marketing in Eastern and Southern Africa. In: *Proceedings of the South-South Workshop on Smallholder Dairy Production and Marketing - Constraints and Opportunities*. March 12th - 16th 2001, Anand, India. NDDB (National Dairy Development Board) and ILRI (International Livestock Research Institute).

Omore, A., Muriuki, H., Kenyanjui, M., Owango, M and Staal, S. (1999). The Kenya Dairy Sub-Sector: A Rapid Appraisal. *Smallholder Dairy (Research & Development) Project Report. 51p.*

Ouma, E., Staal, S. J., Omore, A., Njoroge, L., Kang'ethe, E. K., Arimi, S. M and Njubi, D. (2000). Consumption Patterns of Dairy Products in Kenya. Smallholder Dairy (Research & Development) Project. Consumption Study Report.

Rey, B., Thorpe, W., Smith, J., Shapiro, B.M., Osuji, P., Mullins, G. and Agyemang, K. (1993). Improvement of dairy production to satisfy the growing consumer demand in Sub-Saharan Africa: A conceptual framework for Research. *Market-oriented Smallholder Dairy Research Working Paper 1.* ILRI (International Livestock Research Institute), Nairobi, Kenya.

Staal, S. J. (2001). Smallholder dairy competitiveness. In: *Proceedings of the South-South Workshop on Smallholder Dairy Production and Marketing - Constraints and Opportunities.* March 12th - 16th 2001, Anand, India. NDDB (National Dairy Development Board) and ILRI (International Livestock Research Institute).

Staal, S., Chege, L., Kenyanjui, M., Kimari, A., Lukuyu, B., Njubi., Owango, M., Tanner, J., Thorpe, W. & Wambugu, M. (1998). Characterisation of dairy systems supplying the Nairobi milk market: a pilot survey in Kiambu District for the identification of target groups of producers. *Smallholder Dairy (R&D) Project. KARI/MoA/ILRI Collaborative Dairy Research Programme, ILRI, Nairobi, Kenya. pp. 85.*

Staal, S. J., Kruska, R., Baltenweck, I, Kenyanjui, M, Wokabi, A, Njubi, D, Thornton, P. and Thorpe, W. (1999). Combined household and GIS analysis of smallholder production systems: an application to intensifying smallholder dairy systems in Central Kenya. *In: Proceedings of the Third International Symposium on Systems Approaches for Agricultural Development, (SAAD-III), Nov. 8-10, 1999, National Agrarian University La Molina, Lima, Peru.*

Staal, S., Waithaka, M., de Wolff, T., Njoroge, L., Wokabi, A., Wanjohi, P., Nyangaga, J. and Baltenweck, I. (2001). Integrated household and GIS analysis of planted fodder adoption on smallholder dairy farms in the Kenyan highlands. *In Proceedings: International Workshop on Forage Demand and Adoption by Smallholder Livestock Keepers. ILRI-Addis Ababa, June 18-20, 2001.*

Utiger, C., Romney, D., Njoroge, L., Staal, S., Lukuyu, B. and Chege, L. (2000). Nutrient flows and balances in intensive crop-dairy production systems in the Kenya highlands. *In Proceedings: The 3rd All Africa Conference on Animal Agriculture and 11th Conference of the Egyptian Society of Animal Production, 6-9 November, 2000, Alexandria, Egypt.*