Dairy development

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DAIRY DEVELOPMENT

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ABSTRACT

The growth of the dairy sector as it has occurred in Kilifi and Malindi Districts is one of the few examples of successful agricultural development in the coastal region in the past decades. Between 1985 and 1997 dairy cattle have more than doubled in number. Three livestock systems are described: conventional grazing, zero-grazing and fenced pastures. Particular attention is given to intensive dairy farming by smallholders. Household and herd characteristics are discussed together with the necessary feeding regime and labour requirements. Milk production is reviewed in terms of milk destination, local demand and local consumption. It is argued that the success of dairy development in the districts is the result of three converging factors: the start of a large dairy farm with a dairy factory near Kilifi town; the start of a programme of technical support for intensive dairy farming by smallholders; and the deregulation of the milk trade.

INTRODUCTION*

Livestock was the main source of subsistence for the communities in the drier zones of Coast Province in earlier days. The importance of livestock is reflected in the fact that dowry is still expressed in cattle, although nowadays, marriages are arranged more and more by cash payments. Milk was (and still is) an important product for local consumption. At times of surplus, ghee was processed and traded with coastal towns and cattle were (and still are) important as reserve capital during periods of food shortage. However, since the opening up of the hinterland and the increased access to employment elsewhere, alternative ways have emerged to secure survival.

Immigrants from India settled in Mombasa (and the rest of Kenya) from the early start of the colonial period. They brought a different food culture with distinct preferences for milk and dairy products. The demand for fresh milk in Mombasa stimulated milk collection from farmers in the hinterland as well as keeping of dairy cows in stable on Mombasa Island (the first instance of what was later to be called zero-grazing). Once transport to and from the interior improved, goods were exchanged for milk with herdsmen in

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the hinterland. Mombasa and other stops along the railway line became market centres for the milk from the hinterland. With the emerging national drink, tea with milk, the demand for fresh milk further increased. At first, the milk trade was in the hands of middlemen, but it was taken over later by the Kwale-Kilifi Dairy Co-operative Union (KKDCU) which, in time, started a milk processing plant in Mariakani. Feeder roads were constructed to Bamba in Kilifi District and Kinango in Kwale District with collection and cooling centres along these roads. Milk supply varied seasonally. Figures from the late 1970s showed that the amount of milk handled by the Mariakani plant varied from 30-35,000 litres/day in the lush season to less than 5,000 litres/day in the dry season (Booker 1982).

Despite the integration of the hinterland in the coastal milk market, the quantities of milk were not sufficient to meet the increasing urban demand and milk products had to be imported from up-country. In 1978, KKDCU was taken over by the Kenya Creameries Co-operative (KCC) but the latter company soon discontinued the milk collection in the hinterland. Instead, a new dairy plant was built in Miritini in the early 1980s with a capacity to process 120,000 litres of reconstituted milk per day to supply the national schoolmilk programme, amongst other needs. Milk was processed from imported milk powder and butter oil, at first donated by European countries, while fresh milk from up-country was transported by rail. In addition to schoolmilk distribution, KCC established a distribution network for processed milk and effectively managed to gain a monopoly. It expanded its production at the Miritini plant. The dairy plant in Mariakani continued to receive milk from local producers but KCC failed to make the necessary investments. Consequently, the existing infrastructure deteriorated and local producers again relied on private transport or, alternatively resorted to processing of ghee. In Kilifi and Malindi Districts, however, developments occurred that greatly stimulated intensive dairy farming. This chapter will focus on dairy farming in these districts as an example of what can be achieved under the right conditions.

Kilifi and Malindi Districts

The two districts account for about a third of the coastal population and the agro-ecological conditions are fairly typical for the region, ranging from coastal plain to inland ranching zone. The total number of local/beef cattle has remained almost constant over the past 10 years with official estimates of 200,000 in 1985 (Kenya 1986) and 208,000 in 1996 (Kenya 1997). The largest numbers are found in the hinterland of Ganze and Malindi. The herds are mainly composed of East African Zebu, a multipurpose indigenous breed (Table 24.1). In the period 1985-96, dairy cattle was estimated to have tripled in number from 13,000 to 42,000; although these being government estimates they are probably on the high

Table 24.1 Cattle population in Kilifi District by division, 1996

	Bahari	Ganze	Kaloleni	Magarini*	Malindi*	Total
Local/Beef breeds	18,750	65,280	40,500	26,100	57,390	208,020
Dairy breeds	22,000	930	2,240	3,120	13,939	42,229

* Now Malindi District
Source: Kenya 1997: 6

side. Half of the number probably consists of grade cattle[1], the other half is local Zebu kept for dairy purposes. Dairy cattle is mainly found in the coastal areas, such as Bahari Division and parts of Malindi.

The first important development was the start, in 1963, of intensive dairy farming at a former sisal plantation near Kilifi town. This private company, Kilifi Plantations, gradually increased its herd size and, in time, with several thousand dairy cows became the main milk supplier. It also became the main supplier of dairy stock to development projects along the coast.

One such was the Dairy Development Project (DDP) of the Ministry of Livestock Development. The programme was started in 1980 with technical assistance from the Netherlands Government and ended in 1995. The principal objective was to improve dairy management practices on mixed farms of smallholders, with the introduction of so-called zero-grazing systems. The programme started in six districts in different parts of the country, including Kilifi. This was the second major development that occurred. Initially, DDP selected areas in Kilifi where climatic conditions allowed the cultivation of Napier grass (i.e. CL3 zones in Bahari and Kaloleni Divisions). Earlier attempts to keep dairy cattle in grazing systems had been unsuccessful because of high losses due to cattle diseases (East Coast Fever and Trypanosomiasis). Once DDP proved successful, more farmers gained confidence in the system, particularly attracting farmers located in the coastal plains. In the drier parts of the district a semi-zero system of grazing was introduced (i.e. CL4 zones in Bahari and Ganze Divisions). With the experiences in Kilifi District, the programme was expanded to Kwale and Lamu Districts in 1990.[2]

During the first phase, DDP provided grants to pioneer farmers. Later on it assisted with loans or with obtaining loans from the Agricultural Finance Corporation. Subsequently, in 1992, Heifer Project International (HPI) started activities in Coast Province. HPI works through women's groups (and mixed groups). After constructing dairy units and planting fodder, about half the group members receive a heifer in calf. Members have to pass on the first born female calf, as heifer, to other group members. Between 1992 and 1995, HPI distributed 164 animals (of whom 42 died) to eight groups with 366 members – three groups in Kilifi District (Masha 1998). This particular support and more emphasis on women's participation in general meant that by the end of 1995 about a third of the 300 DDP-farmers were women. The number of DDP-farmers is still growing and it is expected that by the end of 1997 there will be 450 registered DDP-farmers in Kilifi District alone (Mwova 1997). Diffusion of knowledge and improvements in support services have resulted in the improvement of dairy practices and dairy stock at other farms as well.

Apart from technical support and training, DDP has also stimulated farmers to organise themselves in interest groups, for example, the Bahari Dairy Club. This club opened a marketing and cooling centre in Kilifi town in 1987. The annual turnover in 1992 was nearly 200,000 litres (Kenya 1993). In 1996, however, the Club was halted due to organisational and management problems. In 1997, a cooling centre with a capac-

1 According to the New Shorter Oxford English Dictionary grade cattle are crossbred cattle. In Kenya, however, the term is used to refer to purebred animals of foreign stock as well as crossbreeds of local and foreign stock

2 Earlier, in 1982, Taita Taveta had already been included in the programme. However, conditions for intensive dairy production in the Taita Hills were very different. The challenge of livestock diseases was less, while many smallholders were already engaged in dairy farming well before the introduction of DDP.

ity of 2,000 litres was opened in Gede with the support of HPI. It has about 190 dairy suppliers and handles 650 l/day or 200-250,000 l/year, mainly destined for the Malindi market.

The third stimulus for dairy development was the privatisation and liberalisation of the milk marketing in 1992, by which Kilifi Plantations gained access to the urban market, notably Mombasa. In 1995 the company started to process milk from DDP-farmers and other smallholder dairy farmers in addition to the milk from its own farm. By the end of 1997 almost 1,000 small-holders were delivering milk to the company.

DAIRY PRODUCTION SYSTEMS

Conventional grazing

The majority of cattle in Kilifi and Malindi Districts are local breeds kept in conventional grazing systems, mainly in the hinterland. The characteristics of this production system are communal grazing, herding cattle on behalf of others, pooling of cattle, and distribution over several herds. Herd sizes range from 20 to 100 animals. A survey in 1983 showed that more than three-quarters of the herds had multiple owners (2-9 owners per herd) and that nearly one-third of the households had lent out cattle to others in order to spread risks and probably also to hide wealth (Bartman 1984). The fact that different people own livestock in the same herd hampers efforts to improve herd production through investments. Not only ecological conditions but also ownership arrangements are constraints to increase milk production from local herds. In respect to grazing rights, the demarcation of rangeland and group ranching has, on the one hand, given some protection against intruders but, on the other hand, imposed obstacles of its own because animals can no longer move freely to less affected areas during drought periods.

Milk production is seasonal and fluctuates with the quantity and quality of grass in natural pastures. During day-time, the cows and calves graze together. At night, calves are separated from cows and, in the morning, the cows are milked. Cows are in milk for about six months at a time. The amount of milk for human consumption per lactating cow ranges from 0.5-1.5 litres per day. Customarily, the milk is destined for the household looking after the animals, as payment for services. When there is fresh or sour milk at the farm it is customarily offered as a drink to neighbours and other people visiting the household.

Before, nearly every household in the hinterland was involved in livestock farming but this is no longer the case. Surveys in 1985-86 showed that only a minority of the households in the hinterland can derive a substantial income from cattle. Only 32% of the households had more than five livestock equivalents (LE)[3] and 19% had more than twenty LE (Foeken *et al.* 1989). In these households, milk is still important for local consumption as well as for ghee processing. Sour milk is used as a drink or as a relish with food. At the time of KKDCU, fresh milk was sold to the detriment of ghee processing, and according to oral information, even at the cost of household consumption (Gerlach 1963). The collapse of the collection network in the late 1970s may have resulted in more milk for local consumption; however, it is unlikely that this could compensate for the decrease in incomes.

In the coastal hills and in the coastal plain local breeds are kept in similar ways as in the hinterland. However, the environmental conditions are more favourable for ticks and tsetse flies, the transmitters of East Coast Fever and Trypanoso-

3 1 LE (livestock equivalent) = 1 head of cattle = 7 goats/sheep.

miasis, respectively. Death rates among cattle are generally higher and herd sizes smaller than in the hinterland.

Zero-grazing

In 1980, DDP started with the promotion of zero-grazing for smallholders: animals are kept permanently on stable; feed and water are brought to them. Requirements are that there is sufficient land at the farm for fodder cultivation and access to water of good quality. Artificial insemination (AI) reserves the capacity of the unit primarily for the female stock. This production system is labour-intensive but offers a regular income throughout the year. At first, the system was designed for the densely populated areas in the central highlands where land is a major constraint. Results from the first DDP-farms already showed that the output per unit of land compared favourably with that of cash crops (van der Valk 1985; Mwangi *et al.* 1986). However, compared to the up-country highlands, the conditions at the Coast are quite different.

In the rural areas of Coast Province there is more land available per farm, but soil fertility is lower and rainfall less predictable, which makes fodder cultivation more complicated and fodder conservation necessary. A more intensive system of disease control is required. Due to the hostile environment, few farmers possessed the dairy cattle needed to start and most farmers who joined DDP had to purchase suitable animals. For the same reason, female stock was hardly offered for sale and the main supplier for prospective DDP-farmers was Kilifi Plantations. Later, DDP-farmers started to supply each other and newcomers with animals. As a consequence, investment costs at the start were high and participants had to rely more heavily on loans than farmers elsewhere in the country. However, there was the advantage that the coast offered a higher milk price for producers, comparable to the consumer prices for processed milk from KCC.

Fenced pastures

The system of fenced pastures is used at the few large-scale farms such as Kilifi Plantations and was used at the former ADC farm at Kisiwani. DDP has also experimented with fenced pastures for dairy farmers in the interior.

Kilifi Plantations grazes its herd of 2,400 cattle on open fields which are fenced into 100 'paddocks'. At night the animals stay out in the open and are fed fodder and concentrates to supplement the natural grazing. The company has a total of 4,000 acres of pasture and the milk herd is broken up in smaller herds of about 125 animals. Milking takes place in the fields. Young stock and pre-calving cows are kept in separate units. At any one time, about 1,000 cows are in milk (Wilson 1998). Because of its scale and mechanisation, the company is able to conserve fodder of good quality. Artificial insemination and disease control are done at the farm by own personnel (i.e. spraying, 10-day dipping and routine vaccination). In all, the dairy farm employs a labour force of 400, of which 300 are directly concerned with the herds, 100 with the milk plant.

DDP has attempted to introduce an alternative type of zero-grazing in the drier parts of the district. Characteristically, cattle are grazed on fenced pastures in daytime and offered fodder or silage at night. As a result, animals are more exposed to ticks and tsetse flies. In addition, many of the farms share water sources and cattle dips with local herds. Consequently, these semi-zero grazing systems have a higher mortality and a lower productivity than true zero-grazing or on the large-scale farms. At present, semi-zero units compose no more than 10% of the DDP total and

the suitability of this production system is doubtful for smallholders.

The milk production of Kilifi Plantations is in the order of 3.7 million litres/year or 320,000 l/month. Peak production is 380,000 l/m but in the dry months (February-March) production can be as low as 250,000 l/m. All milk is pasteurised at the company plant and, apart from milk, small quantities of yoghurt, cream and butter are produced. The company distributes directly to retailers in the area from Malindi to Mombasa, as well as the South Coast up to Ukunda.

In addition to production from the own herd the plant also reconstitutes about one million litres of milk a year; the powder is purchased from KCC or directly imported. In 1995, Kilifi Plantations took the initiative to start collection, processing and marketing of milk from smallholders, a regional aspect of dairy development that had been neglected by DDP. Kilifi Plantations currently buys about 1 million l/y; 100,000 l/m in peak months and 60,000 l/m in low periods. This development was possible because of deregulation measures in 1992 which gave the company access to markets, notably Mombasa, that were earlier controlled by KCC. The collection area is roughly that around Kilifi Creek and north to Malindi town (in the southern part of Kilifi there is still great local demand for raw milk and farmers there can easily sell their milk). In early 1998 there were 985 farmers recorded with the company; however, there were only 500 which were actually delivering milk – on average 5 l/day. The company provides certain services to regular suppliers, namely provision of concentrates and medicines, sale of animals on hire/purchase terms, sponsoring of a veterinarian, and breeding bulls at outfarms. In a way, Kilifi Plantations has taken over part of the services of the former DDP-programme, which ended in 1995, excepting extension, training and advice services which are not provided.

Smallholder characteristics

The characteristics of the smallholder dairy farms are of particular interest to understand the development of the sector. Farm and household characteristics are discussed at the hand of information from a case study among different groups of dairy farmers and livestock keepers in the hinterland (Leegwater, Ngolo & Hoorweg 1991). This study evaluated the milk production and milk consumption characteristics of different groups.[4] Results concern three dairy systems: DDP-farms; independent dairy farms (neighbours of DDP-farms also keeping dairy cattle) and livestock farms (traditional farmers in the drier hinterland of the district). The general population in the area of DDP-activities was represented by a sample of rural households taken from a parallel study done a year earlier (Hoorweg, Foeken & Klaver 1995).

Household size and farm size were much larger among the three livestock groups than among the general population (Table 24.2). The incomes of the three livestock groups, particularly the DDP-farmers and independent farmers, were higher than that of the general population (Table 24.3). The livestock farmers in the hinterland had a lower income mainly because of the absence of cash crops although their income was still higher than that of the general population.

The livestock income was highest in the group of DDP-farmers (Ksh.13,100)[5], followed by the independent dairy farmers (Ksh.8,500) and hinterland farmers (Ksh.7,500) but in all three groups

4 The findings on food consumption and the effects of increased milk consumption are reported elsewhere (Hoorweg, Leegwater & Veerman 1998)

5 At the time of the study the exchange rate was about 16 Kenya shilling for 1 US dollar

Table 24.2 Household characteristics by type of livestock farmer, 1986/87

	DDP-farms (N=30)	Independent dairy farms (N=25)	Livestock farms (N=11)	General population (N=90)
Household size*	14.9 (8.9)	17.6 (10.7)	15.2 (9.9)	10.0 (5.9)
Farm size (acres, av.)	28.5	25.3	22.6	9.0

* Average number of persons (adult equivalents in brackets)
Source: Leegwater *et al* 1991

Table 24.3 Household income composition by type of livestock farm, 1986/87 (averages in sh/household/year)

	DDP farms (N=30)	Independent dairy farms (N=25)	Livestock farms (N=10)	General population (N=90)
Food crops	6,200	5,300	3,000	2,800
Cash crops	7,700	14,100	100	3,500
Livestock	13,100	8,500	7,500	200
Off-farm income	19,400	18,100	14,800	2,800
Total	46,400	46,000	25,400	9,300

Source: Leegwater *et al.* 1991

livestock contributed 20-30% of total household income. Nearly all dairy farmers belonged to the group of wealthy and middle-class households, not only because of income from dairy farming, but also because of high incomes from cash crops and off-farm employment.[6]

Herd characteristics and development

All DDP-farms owned grade cattle, whereas six farms also kept local cattle. The herds at the independent farms showed a more variable composition consisting of grade and local cattle. At the livestock farms all cattle were of local breed. The latter farms had the largest herd with an average of 39.8 animals. The independent farms had 19.1 animals and the DDP-farms only 6.3 animals. Despite the differences in breeding and farming systems, there was little difference in herd composition; the number of cows ranging from 40-46%; heifers from 21-26%; bulls from 11-16%; and calves from 18-21%.

DDP-farmers succeeded in stabilising their herd size, mainly through sales (Table 24.4). To some extent, this was a necessity given limiting factors such as available labour, number of acres under fodder crop and the physical size of the stable. The death rate at the DDP-farms was relatively high, but important differences occurred between the two sub-systems mentioned earlier; at zero-grazing farms the death rate was only 5% while at the semi-zero farms it was 17%. East Coast Fever and Trypanosomiasis were the main killers and animals at the semi-zero units were more easily infested. In addition, most of these

6 The higher incomes of the livestock groups are partly due to the larger household sizes (Table 24.1). But even when household income was corrected for household size only 3% of the DDP-farmers (N=1) and 4% of the independent dairy farmers (N=1) could be classified as poor (with incomes below Ksh.1,000/adult equivalent) versus 52% of the general population.

Table 24 4 Annual herd development by type of livestock farm, 1986/87 (number of animals)

	DDP-farms	Indep. farms	Livest. farms
At start period ('86)	187	422	449
+ Animals born	60	145	81
+ Animals bought	5	9	14
= Increase	65+	154+	95+
+ Animals died	26	57	70
+ Animals sold	37	41	36
= Decrease	63–	98–	106–
Total increase	+2	+56	–11

Source: Leegwater *et al.* 1991

farms were located in areas (Ganze and Kaloleni Divisions) where cattle density was higher, which in itself increases the risk of contamination with disease. Independent dairy farmers did sell relatively fewer animals and their herds increased considerably in size.

Feeds and feeding

Intensive dairy farming requires more water than traditional farming as well as good quality water. Daily access to a reliable water source is a precondition for DDP-farms. This water is needed not only for the cattle to drink but also to clean the stables and the utensils. Indeed all DDP-farms used piped water although only few were directly connected to water pipes – the majority still had to arrange water transport and storage facilities. DDP promoted the use of donkeys for water transport and the construction of water tanks to store rainwater.

Productive dairy cows have high nutritional requirements which cannot be met by fodder alone and cows have to be supplemented with concentrates. Still, it remains essential that enough fodder of good quality is offered. DDP opted for Napier grass as the principal fodder. Several varieties were tested on farm under different conditions and different cutting regimes (Wouters 1986a; 1986b). Compared with the highlands, production and quality of Napier grass in Kilifi District were generally low because of moderate soil fertility and climatic conditions. Silage making was introduced to conserve grass. Also, Leucena, a legume, was introduced as a fodder crop. Despite the efforts by DDP to stimulate fodder production, the results stayed behind. The majority of DDP-farmers still made use of ordinary grass and half the farmers did graze their cattle on common pastures for one month or more per year, accepting poor feeding conditions and higher risk of disease contamination.

In addition, the DDP-farms and some of the independent farms supplemented the cows in lactation with concentrates – an average of three kg per animal. This compares with an average production per lactating cow of 4.8 litres per day which means that milk production was primarily the result of feeding concentrates and not from feeding Napier grass or other fodder. The favourable price of concentrates[7] did indeed make it attractive to feed concentrates and to give less attention to the quality of fodder.

Farm labour

Labour requirements in zero-grazing systems are high and a large number of people are necessarily involved in the daily production process. Compared with traditional production systems some activities are new, while others have to be carried out more intensively. Fodder has to be harvested and transported every day to the stable to be chopped and fed to the animals. In many cases water has to be collected and transported; the

7 The market prices for concentrates at the time were low (Ksh.0.6 to Ksh.1.0 per kg for maize bran and Ksh.1.2 to Ksh.1.4 for copra cake), while milk prices were high (Ksh.4.0-5.5 per litre).

stable has to be cleaned and the manure brought back to the Napier fields as fertiliser. Calves are reared separately from the cows, which are milked twice a day; the milk has to be sold or delivered in time. Disease control and breeding demand more attention, and so on (Wouters 1986c).

At the 30 DDP-farms in the study, there were 62 persons responsible for one or more activities; 38 family members and 24 labourers. Family members were mainly men: the head and/or his son(s). At a quarter of the DDP-farms women were actively involved; some even as de facto managers, notably at farms that employed labourers. Labourers were employed at 16 farms; at 13 farms they did all the work. At the 25 independent farms, 46 persons were involved mainly in dairy farming; 36 family members and 10 labourers. At eight farms the labourers performed all daily work. At the livestock farms in the hinterland only family members were involved in the care for the animals.

Comparing DDP-farms with independent farms, the number of people involved in dairy farming was about the same; about two persons per farm, on average. However, the groups looked after a different number of animals: three animals per person at the DDP-farms and ten animals per person at the independent farms. In other words, the main difference is not that DDP-farms employ more people but that production is realised with fewer animals than at the independent dairy farms.

Table 24.5 Average daily milk production and cows in lactation by type of livestock farm, 1986/87

	DDP-farms (N=30)	Indep. farms (N=25)	Livest. farms (N=11)
Milk production (litres)			
per farm	9.4	5.1	3.8
per lactating cow	4.8	1.9	0.7
per cow present	3.4	0.6	0.2
Cows in lactation (%)	68%	34%	36%

Source Leegwater *et al.* 1991

SMALLHOLDER MILK PRODUCTION

Milk production per cow and milk production per farm were much higher at the DDP-farms (Table 24.5). The percentage of cows in lactation was twice as high as at the independent farms and at the farms in the hinterland. At the DDP-farms, evening milk represented 38% of the production. At the independent farms only three farms had evening production and in the hinterland group none.[8]

Milk destination

Most of the milk was sold (Table 24.6). At the DDP-farms, 80% of production was destined for sale. About a quarter went to destinations outside the location, the rest to local consumers. The independent dairy farmers and livestock farmers sold about two-thirds of the production. Nearly all these sales were in the nearby location. DDP-farmers reserved about one-fifth of the milk for home consumption; among the independent dairy farmers and livestock farmers this rate was higher (about a third). In absolute terms, the differences were smaller and had a different order: independent farmers reserved 1.8 litres for home consumption, DDP-farmers reserved 1.6 litres and livestock farmers 1.2 litres.

8 Further analysis revealed that the group of independent farms consisted of two subgroups: (i) farms with cross-bred cattle focusing on milk production; and (ii) farms with local breeds where milk is a (welcome) by-product. In the first group the average production per cow in lactation was 3.1 litres/day, much higher than in the second group (0.8 l/day). The latter figure corresponds with production figures from the hinterland herds with an average of 0.7 l/day.

Table 24.6 Destination of milk production by type of livestock farm, 1986/87 (% of total production)

	DDP-farms (N=30)	Indep. farms (N=25)	Livest. farms (N=11)
Local sales	56	55	50
Sales outside location	23	–	10
Home consumption	17	35	32
Left over at end of day	4	10	8
Total	100	100	100

Source: Leegwater *et al.* 1991

Local customers

Examination of local customers – 24 regular clients of DDP-farmers – showed them to consist primarily of wage earners. The heads of households had permanent jobs near home and their level of education was relatively high. More than half were employed by the government (N=14), e.g. as teacher or extension worker, others were self-employed (5) or working in the private sector (2). The group was further characterised by smaller households; 25% of the households had fewer than five members. Income and income composition were atypical for rural households. The average household income was three times higher than that of the general population and about three-quarters of the household income was from employment.

Local consumption

Milk consumption at the time was generally low in the rural areas (Kenya 1981; Hoorweg *et al.* 1991; Niemeijer, Foeken & Klaver 1991). Nearly all DDP-farmers and dairy customers, however, reported regular milk consumption while this was only the case with 10% of the rural population. Milk was nearly always used with tea but 50% of the DDP-farmers and their customers also used it as a drink, most likely for the children. The DDP-farmers consumed about 1.5 litres/day; the customers about 1.0 l/day (but their consumption per person was higher because of smaller households). Milk consumption among the general population was quite low: 56 ml/household/day. Clearly, milk was too expensive for these households and this was indeed mentioned by respondents. The study from which the above results are taken also found that the higher milk consumption is of benefit to the children. Children of DDP-farmers and customers, irrespective of income differences, scored higher on the measures of anthropometry generally taken as indicators of nutritional status (Hoorweg *et al.* 1998).

Discussion

Rural development

Dairy farming as an economic activity can broaden the resource base of the region and thus contribute to rural development, i.e. improve the living conditions of rural households. Among the various kinds of agricultural commercialisation, dairy farming is unique in that it entails the production of a high-quality food that can be used for sales as well as for home consumption. Used for home consumption, milk is important for young children and pregnant and lactating mothers. If sold, milk sales provide a steady, daily flow of income; quite different from the usual bulk payments for most cash crops. Milk sales for local consumption may benefit other households in the community thus contributing to the improvement of nutritional conditions of farmers and customers alike. However, the price for milk remains a constraint for those who need milk most.

Dairy production

Local herds of East African Zebu under grazing systems still produce the major share of milk in Coast Province. In Kilifi District, where intensive

dairy farming is the most advanced, milk produced by local herds (210,000 heads producing 20-25,000 litres/day) is about the same as that produced by grade dairy cattle (20,000 heads producing an estimated 30,000 litres/day).[9] The major differences between these herds are that the local herd is producing milk from grazing natural pastures while milk production by the dairy herd is mainly based on the feeding of concentrates; and that most of the milk produced by the Zebu herd is locally consumed while most of that produced by the dairy herd enters the market.

DDP has succeeded in creating a viable smallholder dairy system in a hostile environment for grade cattle. Where other systems failed, the concept of zero-grazing provided the conditions required to keep diseases under control as well as for a high and regular milk production. The positive balance of female stock is rather unique for smallholder dairy projects (De Jong 1996). Prospects for sustaining the system are good as progress has been made in the control of East Coast Fever through pre-immunisation by artificial infection and treatment (Thorpe 1993). Other purported benefits, such as a more intensive exploitation of land (important in densely populated areas with a high ecological potential), were less clear in this case, the average size of the DDP-farms was 28.5 acres with 12 acres near the homestead. This confirms that dairy farmers belonged to relatively wealthy households with access to sufficient capital; even more than strictly needed for investment in a dairy unit.[10] For that reason it is likely that dairy farming will remain out of reach of most rural households that already have problems to sustain a minimum level of existence (Hoorweg *et al.* 1995).

For the latter households the positive aspect of the programme was the increase in employment opportunities at farms of the more wealthy households. About half the dairy farms did run the dairy unit with family members. The other half employed labourers. The latter farms had more cattle, farmers were wealthier and were more involved in off-farm activities than the first group. In the case of households employing labourers it seems that the investment in a dairy unit was a choice out of many opportunities. Despite the fact that the production system is labour intensive, it did not compete with other economic activities because the labour requirements were met by hired labour; in contrast with the farms not employing labourers. The latter group was more engaged in agriculture. If they desired to enlarge the dairy unit they had to reduce other activities or hire labourers, the costs of which come on top of necessary investments. Since they had lower incomes it was more difficult for them to take this step.

Dairy consumption

Milk production at the Coast is still far behind demand. Milk and milk products are imported from up-country. Consumer prices for milk are

9 It is assumed that in the local Zebu herd of 210,000 animals about 10-12% of the animals are cows in lactation with an average milk production of 1 l/day per cow In the dairy herd of 20,000 animals 30% of the animals are assumed to be cows in lactation with an average production of 5 l /day per cow

10 The study described the situation ten years ago among the first group of participants. There is no reason to expect that since that time differential changes have affected the groups that were compared The households that joined later had to meet the same requirements The economic risk of dairy farming is relatively high, in particular when the unit counts only few animals. In general it is unlikely that farmers will invest all their capital in intensive dairy farming, they will need to reserve some capital for security. An evaluation of the original DDP demonstration farms all over Kenya confirmed this: of the farmers who had failed (30%), the majority mentioned lack of capital as the main reason and the loss of animals next (Voskuil 1986).

relatively high in this part of the country. Consequently, producers who deliver directly to consumers can easily compete with processed milk and still fetch a good price. Processors of local milk also have the advantage that transport costs can be low while processing can be limited to pasteurisation. However, with a higher milk production, DDP-farmers face the problem of marketing, a problem they share with independent dairy farmers and livestock farmers in the hinterland. The opportunity to deliver milk to Kilifi Plantations has greatly improved the marketing conditions for a large number of small farmers. Kilifi Plantations has access to milk markets in Mombasa and Malindi and prospects to market more milk are promising. The feelings in the industry are less optimistic, however, because of fear of stagnant production levels and increasing costs (Wilson 1998).

Fears generally exist that when dairy farming is commercialised, farmers will reduce the amount of milk kept for family consumption. Such trends were observed earlier in the hinterland of Kilifi and Kwale Districts in connection with the Mariakani Milk Scheme mentioned earlier (Gerlach 1963). The danger was also mentioned in connection with Operation Flood, the large dairy scheme in India (Doornbos *et al.* 1990). However, the objective of DDP was to create new production units and not to market milk from existing units and, in this case, the dairy farmers indeed kept 1.5-2.0 litres a day for home consumption.

The local clients for DDP-milk consist of households with better paid jobs, either employed in the non-agricultural sector or employed by the government. They and the dairy farmers often use milk as a drink, most likely for the children. There are few customers among the rural households which confirms the existing insight that milk is not an important means to improve nutritional conditions among low income rural populations (DGIS 1992). Milk is an expensive source of energy and protein and even when used as an ingredient, for example to add to maize to increase energy density, it is still more expensive than preparing a porridge of maize, vegetable oil and beans.

CONCLUSION

The general performance of the agricultural sector in the Coast is poor and farmers have shown little interest to invest in the modernisation of agriculture (Kenya 1985; 1986; 1989; Waaijenberg 1987). In fact, rural areas have to cope with a decreasing interest in agriculture in favour of off-farm employment. Many adults are involved in off-farm employment and two-thirds of the rural households derive an income from this source (Hoorweg *et al.* 1995). DDP has, at least, stimulated an inverse flow of capital and created employment opportunities in the agricultural sector.

Intensive dairy farming in Kilifi and Malindi Districts is the result of three different developments. The start of a large dairy farm and dairy factory by Kilifi Plantations; the project support for intensive dairy farming by smallholders; and the deregulation of the milk trade. Since Kilifi Plantations has only recently gained access to a wider market there is no reason that an increase of local production will result in lower prices. In the mid-term, at least, there will be sufficient demand for local milk. Competition, however, may come from up-country producers although these will face high transport costs. Long-life milk, imported from South Africa, has already appeared on the shelves and the more efficient dairy industry in South Africa may pose the real threat.

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