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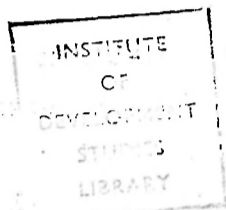
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Some Economic and Technical Aspects of Milk Production on Small-
holdings in Kilimanjaro and Meru Districts of
Tanzania.

By
Fadhili Daudi Mbaga.



1. Introduction.

Research into technical and economic aspects of dairy farming by smallholders in these areas has not been neglected. During November - December, 1965 Fairo carried out a survey of six farms among members of Marangu and Mamba Cattle Society at the request of Government. The survey was analysed by a Field Officer in September, 1966, and useful conclusions were arrived at.

The present paper also covers a small survey in which information was obtained by a single visit to 10 farmers on Kilimanjaro and Meru, plus discussions with the Veterinary, Animal Husbandry and Agricultural Extension Staff of the areas. This survey arose out of answers given to the author by farmers from these areas in another inquiry regarding their future intentions on coffee. As a reaction to falling coffee prices, many farmers talked of taking up grade cattle keeping as an additional economic activity. This inspired the present writer to look into dairy farming as an aspect of coffee diversification at farm level.

Field work took 3 months, in which period the author was also engaged in a coffee crop study. The survey was dry interviews, lasting about 3 hours. I am grateful to the Agricultural extension staff, who took me around their areas. They helped me beyond the point of duty. My thanks are also due to the farmers, who willingly co-operated. The findings must in a large measure be regarded as a child of farmers' memories, since few of those interviewed kept records. The seriousness of the errors in detail may not be much, and, to quote from a similar study in Uganda in 1966, "such errors are probably less in an occupation such as dairying where inputs tend to be regular than arable cultivation where input variations between seasons and years are great" (1)

2. Evolution of Dairying on the Mountain Slopes.

The history of the now fast-developing grade cattle enterprise by smallholders on Kilimanjaro dates back to 1962, after independence. Prior to that, only commercial dairy farms were receiving Government departmental attention, and the Government's policy discouraged smallholders

from keeping grade dairy cows, the argument being that these farmers lacked the knowledge and experience to manage this type of enterprise. It seems to have been overlooked that even expatriates on commercial dairy farms needed adaptation and received further technical assistance.

In 1962, the Government embarked on a policy of encouraging the development of 2 - cow stall-fed units in all intensive coffee-banana areas on Kilimanjaro and Meru mountains. A large - scale milk production scheme was thought uneconomic, milk collection and distribution being difficult on these mountainous areas. The aim was to achieve local self-sufficiency in milk on the mountains, thereby creating milk surplus in the lower areas which could be sent to a milk plant then anticipated, and now in operation in Arusha. It is now thought and recommended that 10 - 20% of the areas' farmers should be professional dairy-men, supplying milk to neighbours, if the demand for milk on the mountain is to be adequately catered for (1) These estimates are based on present average milk yields of 2 gallons per grade cow, and a household consumption of 6 pints per day. (2) For Kilimanjaro alone, this would mean 15 - 20,000 dairy grade cows on the mountain.

3. Dairy Cattle Societies and Government Assistance.

A number of cattle societies have been formed for the following purposes:-

- a) To encourage good and proper animal husbandry and feeding of dairy cattle.
- b) To help the members in purchasing grade dairy cattle and in marketing their dairy products.
- c) To encourage the use of Artificial insemination.

The first part of (b) above is open to many interpretations. Some farmers have joined cattle societies before they acquired a grade cow in the hope that the society will loan them money to purchase a dairy cow. Finding out that no such loans were available, they quitted the societies. At present, the farmer sells his milk "over his door steps" - but in time, the local marketing of milk may meet difficulties, and provision for the cattle societies to organise the marketing in future is a welcome thing.

Additionally cattle societies facilitate extension activity. Through these societies, bulk order and deliveries of Lucerne hay have been arranged for society members.

(1) An Economic Survey of Dairy Farming in Uganda
Department of Agriculture,
Ministry of Agriculture and Co-operatives, 1966, p. 2.

Government assistance to dairy farmers is directed towards those who are co-operative. The Agricultural Division of the Ministry of Agriculture and Cooperatives maintains contact with grade-cattle sellers and informs intending buyers of the availability. This assistance is limited to those farmers who fulfil certain conditions regarding fodder, housing for cows, sprays pumps etc., and who have been favourably reported on by their local AFOS. This is an attempt to ensure that cows do not fall into the hands ill-fitted to handle them, which may bring disrepute to the whole movement. The animal husbandry staff administer vaccinations to members of cattle societies only. Advisory services as a whole including instructive leaflets, have been provided to society members.

Cattle society membership is open to any person on the slopes of Mts. Kilimanjaro and Meru owning improved dairy cattle. It is understood though, that many owners of grade-cattle are outside these societies. As many as 1500 units were reckoned outside cattle societies in Kilimanjaro in 1966. (1)

If services are limited to society members only, the Ministry may well place itself beyond the reach of those who need it most. Dedicated members may be irked when a next-door neighbour farmer applies for membership who has known all about the cattle society for months or years, but has waited to join when some kind of emergency occurs and he cannot find help elsewhere. For such a man, the Ministry has a duty to extend help so that the farmer ceases to be a community outcast.

4. Artificial Insemination Scheme.

A pilot A.I. Scheme was set up at Marangu (Moshi) in April, 1964, in order to determine the problems of operating such a scheme. By means of films, lectures and farmers' visits to the Central Artificial Insemination Stations at Kabete (Kenya), the required support of the Marangu-Mamba (Cattle Society) was obtained. Following great public demand, a similar scheme was opened at Machame in August, 1964. The scheme was extended to Meru in 1965. Yet another A/I station was inaugurated at Kirua Vunjo (Moshi) in 1966.

Semen has been transported from Kabete to Moshi (about 230 miles) by bus in a crated thermos flask, the cost being met by CAIS, Kabete. The frozen semen cost Shs 10/- per ampoule of 1.c.c. early in the scheme, but recently the cost was reduced to Shs 8/-. Replacement dry ice arrived in a similar manner, 2 or 3 times a week, and fresh semen supplies were ordered by telegram. In a few cases a number of farmers' calls have been missed due to late arrival of semen from Kabete. Having the dry semen arrived in Moshi/Arusha, it cost about another Shs 2/- to transport it into the rural centres by local buses. The cost per insemination varies a little from society to society:-

Marangu	Shs 12.50
Machame	Shs 13.50 for first service

and Shs 13. 00 for subsequent services

Arumeru Grade Cattle Society Shs 12. 50

i.e.
(Arusha-Meru)

The high cost of semen and the additional costs of repeat inseminations are arousing complaints from farmers. When repeated 3 or 4 times farmers have been discouraged and there are cases where cattle society members have taken their cows to local bulls, contrary to an agreement which they have to sign when they join the scheme. It is here suggested that a flat charge at a higher rate (Shs. 25/- to 30/-) per positive pregnancy be introduced.

Transport of inseminators (who are usually AFOS) is a problem in these mountainous areas. The AI is spread over a wide area with a low density of cattle. OXFARM has been closely linked with the development of AI and donated until August 1967 £6000 as a grant. (1)

Recent developments point to a difficult immediate future for the scheme. With the inauguration of the East African Community, Kabete is "unable to supply semen due to customs regulations" West Kilimanjaro Government Livestock Breeding Station had to step up its efforts to obtain semen from their bulls, but they have not yet developed equipment that would preserve the semen, and all that they produce has to be used within 5 days.

5. Growth of Dairy Cattle Population.

Since the change in Governments policy and the introduction of AI Schemes, appreciable forward strides have been made. The figures below also include importations of Jersey in-calf heifers from Kenya.

Table I
Grade Dairy Cattle Population - 1966 Statistics

Centre	No. of Members	No. of Grade Cows
Marangu/Kilema & Mamba	341	389
Machame	148	250
Kirua Vunjo	120	300
Kibosho, Old Moshi & Uru	150	200
Rombo-North & South	126	218
Meru	?	230

(1) The Place of Dairy Cattle in Kilimanjaro Region, Tanzania (Conference Paper - August 1967) p.2.

Source: Dairy Industry - Kilimanjaro Region - 1966 Ref VY/1654
- Ministry of Agriculture and Cooperatives
Agricultural Officer's files (Livestock) - Arusha

In 1966, it was believed that 1500 units of grade cattle owners were outside cattle societies in Kilimanjaro, and in Meru likewise, farmers bought and kept grade cows without the knowledge of local staff. In all, it is estimated that there are just over 3,000 "professional" dairy cattle and about 80,000 Zebus on Mt. Kilimanjaro. There is thus a long way to go before the aim of local self-sufficiency in milk can be attained. And since supplies of cows from Kenya do not seem to be readily available, the greatest opportunities for improving the quality of livestock seem to lie in cross-breeding with local zebus. A major criticism of the scheme is that it is not planned to establish so many dairy farms per year for so many years.

Extension Staff

Since 1963 extension responsibility was transferred from Animal husbandry to Agriculture. There is cooperation between the two divisions, and it seems to be working well.

Ideally, it is reckoned every dairy cattle farmer should be visited once a month. However, there is a shortage of staff and it is only possible to visit a farmer once in three months; except in the following special cases:

- a) farmers who have just acquired a grade cow from Kenya or locally.
- b) farmers whose cows are about to calve
- c) those rearing heifers - especially in the first 6 months of the heifer's life.

The Economics of Keeping 2 Jersey Cows /acre (stall-fed) over one lactation period. (At start of enterprise).

Being encouraged on Kilimanjaro and Meru are Jerseys - a small, delicate cattle giving rich milk and requiring less food for maintenance than heavier breeds, like Friesian. Jerseys make an ideal cow for single households with enough succulent food as around these mountains.

Following the analysis of Taira's survey there was an attempt at calculating approximate costs and profitability of keeping a Jersey cow/acre of gross over a one lactation period. However, observations indicate that 2 cows /acre is a more representative unit of what an acre of gross can carry in these areas. A Jersey cow eats about 90 - 100 lbs of gross per day. This is $100 \times 365 = 36,500$ lbs per year. It is estimated that an acre of setaria (given good soil), yields 40 tons of grass in a year (1) This is $2240 \times 40 = 89,600$ lbs - enough for 2 cows feeding 120 lbs of gross per day. On this basis therefore, the present study proceeds on a 2 cow - unit per acre. Secondly, land value

of Shs 3,000 / = per acre sown with grasses in the Tairo's study has been here omitted wholly. The tendency is to uproot coffee and give place to grasses rather than new land purchases.

Table 2.

1. Initial Development costs:

	Shs.	Cts
1. Acre - sown with grass at cost of farmer's labour	-	-
Housing for cows (iron roofed, cemented floor)	1000	00
Spray pumps - Coopers Nest Hill 3033	115	30
Equipment - buckets, bowls, thermometer, blood slides etc.	58	00
Purchase of 2 Jerseys from Kenya - including transport	2600	00
Total	3773	50

Standard of Housing

Housing of animals on the mountains was satisfactory as most of the farmers had to build a standard cattle shed planned by extension division before purchasing a grade cow. Prestige of grade cattle ownership would also seem to have a place in building rather expensive houses. Although farmers are advised to have wooden feeding troughs, most continue to build cemented ones. Some of the farms are still over-capitalised on housing as farmers built houses for 3 or 4 cows when they only kept 1 or 2.

Purchase of cows.

Present owners of grade cows obtained them at prices lower than those ruling to-day.

Spray pumps - Until recently only C.J.S. spray pumps were available at Shs 240/- Now farmers are encouraged to use Cooper's Nest Hill pumps, which are cheaper and can do the job well. Some farmers avoid this item of expenditure and use coffee copper spray pumps for spraying cows against ticks. These pumps lack sufficient force behind them for the job, and are

1. Ufugaaji wa Ngombe - Msinga Farmers Training Centre.
Marbo Makubwa katika ufugaaji

are being discouraged.

2. Feeding

The Chagga and Meru people keep the animals indoors and are stall-fed on an improved traditional version of husbandry - using banana leaves and peels, maize stems, grass and crop residue from the lower areas. The grass from lower areas is soiled, cut from the bush and sold to farmers at 50 cents per bale. Many cow deaths have been due to tick-borne diseases. This type of feeding has been prompted by a dense population in these areas, exceeding 1,000 people per square mile in some cases. Farmers are advised to feed concentrates and supplement immediately before and after calving. Lucerne hay is a very valuable supplement now available at Miwaleni (Moshi) on a FAO Irrigation scheme at Shs 4/= per bale of 50 lbs ex-Miwaleni.

Grass plots of $\frac{1}{2}$ - 1 acre (mainly seteria splendida) are well maintained by farmers, and in 1966 it was estimated that over 75 % of the cat cattle owners in Kilimanjaro had these plots ⁽¹⁾. A few have now started developing lucerne plots as well. The trend is to uproot some coffee trees for the planting of fodder crops.

Feeding practices varied greatly in the survey, but most farmers now using concentrates, which can be bought from the Tanganyika Farmers Association in both Moshi and Arusha. Six of the 10 farms had feeding costs of about Shs 500/= per lactation; the others showed lower figures. There is an urgent need of disseminating handout-literature, and it is suggested in a form of a wall-chart of requirements, which a farmer can place in his cow stall for easy reference. The art of "steaming up" cows before they calf is practiced by only a few farmers.

Table 3.

Current Costs of feeding - 2 cows.

	Shs	Cts
Seteria - at cost to farmer's labour	.	-
Lucerne hay - 8 lbs /day per cow for 4 months(dry season)		
Say 40 bales @ 4/- per cow	160	00
Maclik plus - 1 bag 4 $\frac{1}{2}$ lbs @ 3/50 last approx.1 month		
say 13 bags /one cow for 13 months - 2 cows		
(i.e. Lactation interval)	91	00
Wheat bran - 100 lb bags @ 12/50 - Last about 20 days		
1 cow for 7 months	128	00
Dairy Meal - 4 lbs/day for 7 months @ cow		
Shs 44/50 per bag of 150 lbs	534	00
Say 12 bags for 2 cows.		

The cost of transporting concentrate feeds from Arusha/Moshi to rural centres has not been included in the above table.

Table 4
Other Current Costs

	Shs	Cts
Garnatox Spray vs ticks - x 2 weeks		
1½ oz per tin of water each time per cow		
2 lbs Pkts at 7/- (Say 10 Pkts. for 2 cows per year)	70	00
Vaccinations : Black quarter and Anthrax - x 1/year		
Shs 1/50 per cow	3	00
Haemorrhagic Septicaemia - x 2 /year		
@ Shs 1/50 per cow	6.	00
Foot and Mouth - x a /year (a) Shs 2/50 per cow	10	00
Artificial Insemination - say x 2 per cow	50	00
Coopers Milking Salve - Shs 3/50 per small tin		
5 tins per lactation for 2 cows	17	50
Coopers Py-Grease (for keeping off flies) @ Shs 3/25		
10 tins last 1 lactation for 2 cows	32	50
Cattle Society Membership fee/year.	30	00
Total	2 19	00

Disease Control

Control of ticks by spraying was practised on all the farms visited, but the cost of this varied considerably., suggesting that on some of the farms it was erratically done. In the avily tick-infested areas, Altik is used in addition to Garnatox or to Cooper-tox. Vaccination campaigns are rather disorganised and it is intended to introduce an enrollment scheme where farmers pay the fee in advance to avoid wasting time visiting farmers who do not want vaccinations for their cows, or who have not the money to pay for at the time of the visit. Disease control constitutes only a small part of total costs.

Milk Production

This was rather difficult to assess as only 3 of the farmers surveyed kept milk records. Five of the farmer allow the calf to suckle the cow, while the rest used bucket feeding.

Farmers who get 3 gallons or more a day at peak production milk three times a day, and those who get 2 gallons of milk twice a day. Still some farmers believe that if a cow which is milking heavily is served, then milk production will drop off. They wait until the cow is almost dry before serving her. In some cases the farmer, and now less often the inseminator, fail to notice when the cow is on heat. The stall-feeding system itself, which keeps the cow in shed all day, makes it difficult to notice when the cow should be served. Failure to notice when a dairy cow should be served reduces the annual production of milk and increases the overhead expenses of keeping it.

Table 5.

Average Milk Production.

These figures are estimates based on feeding practices and current milk yields.

Yields of $2\frac{1}{2}$ gallons for 3 months	225 gallons
Yield of 2 gallons for 2 months	120 "
Yield of $1\frac{1}{2}$ gallons for 3 months	135 "
Yield of 1 gallon for 2 months	60 "
	<hr/>
Total Milk Yield per Lactation	540 gallons

As the standard of feeding improves, milk yields should increase with time. Milk fed to a heifer calf has been deducted from above calculations.

Calf Rearing.

All the farmers reared heifer calves as a replacement for their own stock. Those who allowed the calf to suckle the cow were afraid of bucket feeding, thinking that the cow would not "let down" milk without the calf. They are encouraged to use the early - weaning method off milk at 8 - 12 weeks accompanied by Calf Early Weaner Pencils. However, they all used inadequate calf pencils and did not wait until the calf was eating 4 lbs of pencils per day before weaning off milk. Even with milk-feeding, desirous of getting the earliest and maximum return from their milk sales some farmers maintained their calves in a state of undernourishment. The

initial set back in early calf life has a drastic influence on the eventual profitability of the animal. It has been suggested that heifer calves would better be reared by Government and later sold to the farmers at subsidised rates, and some farmers have indicated their readiness for the proposal, provided they are assured of the possibility of acquiring the calf later. In Kilimanjaro, a bull calf may be sold to the Livestock Breeding Station, West Kilimanjaro at Shs 20/- each at one week old and a heifer calf, if any at Shs 40/-

Table 6.

Cost of Rearing a Heifer Calf.
(Early Weaning at 8 - 12 weeks)
(Milk at = /65 cents per pint).

We assume that in the 2 cows per acre, one will give a heifer calf and the other bull calf. Only 1 heifer calf is therefore reared. Bull calves are slaughtered at an early age. Estimates are based on current recommendations.

	Shs	Cts
1 Month 6 Pints Milk /Day	117	00
5th - 7th Week 4 Pints Milk/Day	54	60
8th - 12th Week 2 Pints/Day	45	00
Calf Early Weaner Pencils Shs 63/- per 150 lbs i.e. = /42 cents per lb.		
14 - 30 Days av. $\frac{1}{2}$ lbs /day	3	36
5th - 8th Week average 2 lbs /day	25	20
2 - 18 Months 4 lbs/day	297	00
Vaccinations (including Brucellosis S.19 for life immunity)	9	50
Total	552	16

A reason frequently given for rearing heifers for replacement by farmers was limited capital resources to buy in calf heifers. As with many management problems, no one answer applies to all circumstances. In general though, many of these farmers, with a few cows and small acreage, might make greater profits by buying - in replacements. The limited acreage and labour would be more effectively utilised. But as long as no in-calf heifers are readily available for purchase, these farmers will continue to rear their livestock replacements. Other advantages (uncosted) of rearing replacements are:

- a) the calf is born in a stall-feeding system and therefore is not disturbed by lack of freedom,
- b) the animal is accustomed from the start to local feeds.
- c) it is adapted to the mountain climate
- d) the record and performance of the animal is known,
- e) there is precaution against bringing new diseases on the farm.

Labour Input.

On three of the farms surveyed farmers employed outside labour, paying them between Shs 60/- - 90/= per month, depending if these labours got food as well or not. Most of this labour was under-employed as the number of cows was small. Wives did most of the work connected with dairying, and it is believed they are the persuasive force behind the husbands for the family to keep grade dairy cows. Employing outside labour is unjustified, as this item raises costs appreciably.

There is an interesting correlation between the building of cooperative Central Coffee Pulperies and taking up additional economic activities by the farmers. The pulperies have given farmers more time at their disposal, and many have taken up grade cattle keeping, poultry, and pig keeping is on the way.

Table 7.

Calculated Income from Milk Sales

Average sale price =/65 cents per
pint. Average household consumption
6 pints/day/household

Milk from Two Cows	Income /day	
	Shs	Cts
Yield of 5 gallons for 3 months	22.	10
Yield of 4 gallons for 2 months	16	95
Yields of 3 gallons for 3 months	11	70
Yield of 2 gallons for 2 months	6	50
<u>Thus Income</u>		
First 90 days	1989	00
Next 60 days	1017	0 0
Next 90 days	1053	00
Next 60 days	390	00
	<u>4449</u>	<u>00</u>
Value of milk for household consumption	1170	00
	<u><u>5619</u></u>	<u><u>00</u></u>
Total		

Table 8.

Gross Margin for a Two Cow Unit.

<u>Gross Margin</u>	=	<u>Gross Output</u>	-	<u>Variable Costs</u>		
		Shs	cts		Shs Cts	
(1) Income from milk sales		4,449	.00	(1) Cattle feed-stuffs	913. 00	
(2) Value of Milk for household consumption		1,170	. 00	(2) Other re-Current Cost	219. 00	
(3) Sale of Jersey Heifer at 10 months old		700	00	(3) Cost of Rearing one Heifer Calf	522. 16	
		6,319	. 00			
Minus (4) Cow Depreciation (2 Cows)		450	00	(4) Wages	900 00	
		5,869	. 00		2,584.16	
GM =		Shs 5869	-	Shs 2,584.16	=	Shs <u>3,284.84</u>

Percentage Return to Capital $\frac{3284 \times 100}{3773.50} = \text{Approx. } 91\frac{1}{2}$

Note Heifer sale price is based on local prices of well-reared calves. We have assumed that one of the cows gives a bull calf and the cost of rearing this is assumed to be Nil. Bull calves are slaughtered usually at the age of one week. Gross Margin calculations would have been considerably different if both cows had a heifer calves. The average economic life of a dairy cow in these areas is 5 years.

Later on, it will be possible to compare the Gross Margin for a two - cow unit with Gross Margin /acre of coffee interplanted with bananas.

Conclusions.

- 1) It is often found that the real-cash return to the farmer is low especially where one cow is kept, not so much because of poor production methods or low yields, but the output is not large enough to leave a satisfactory income to the farmer.
- 2) Household milk consumption is high (shs 117. 00 per month) and it is doubtful if a similar quantity of milk would be bought each day if it was not produced on the Shambas. The keeping of grade cows has therefore a beneficial effect on the health of the family, although producing only a low cash income.
- 3) Capital costs on buildings and equipment are rather high, for the reason that they are spread over a few animals.
- 4) Profits would be increased by reducing the calving interval. It is reckoned most cows calve once in two years, though a few calve within 18 months.
- 5) Generally, employing outside labour is unjustified, as it inflates costs considerably in a situation where only a few cows are kept.
- 6) The cost of rearing heifers is high, and in most cases the farmer would earn greater profits by buying-in replacements. But as replacements are not readily available, farmers will continue to rear their own heifer calves until they are well-stocked

References

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Artificial insemination
Agricultural Extension

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