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J.D. Mbaga
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The Productivity and Profitability of Coffee Enterprises in Kilimanjaro and Meru Districts of Tanzania - An Estimation

(A) A Note on Technical Improvements and Farmers' Response

Looked at as an economic enterprise, the success or failure of coffee growing depends upon its production costs, level of output, and prices paid to farmers. Under the International Coffee Agreement Tanzanian producers have no direct influence on the price received. The Agreement apart, Tanzania's contribution to total world coffee production is so small that, unilaterally, she cannot influence world market prices either by her production or surplus stock policies. However, qualitywise, despite the lack of an international code on coffee quality, the trade recognises a good quality product and as the farmer can play an important part in improving quality he can realise higher prices. In Tanzania, government research and experimental work on coffee is carried out in all important coffee growing areas to investigate into improved economic means of producing good quality coffee. The results are compiled by the researchers and published by the Tanganyika Coffee Board.

Through these reports important research findings are disseminated to the extension staff of the Ministry of Agriculture and Cooperatives. In some cases a liason officer has been appointed at the Research Station. The educational needs of farmers are further met by Farmers Training Centres, which organise that courses. Farmers are usually recruited by a member of the field staff of the Agricultural Extension Division, who also attends the course with his recruits and is able to follow them up later.

Coffee research work covers many aspects, only a few of which are cited here to clarify some points. Summarising research findings in the annual coffee report of 1961, it is stated "a variety of evidence has been preserved which shows that bananas interplanted in either young or mature Arabica coffee, unshaded or lightly shaded, reduces crop yields to a substantial degree under conditions at the Coffee Research Station, Lyamungu, and over a part of the main coffee area on Mount Kilimanjaro. No attempt has been made to evaluate the economics of mixed coffee banana plantings and it has been assumed that the primary objective is the production of high yields of quality coffee."[1] Though the writer of the report is right in defining the limitations of the research work done, for decision-making purposes the separation of the economic and technical dimensions of the problem is a significant blemish. The opportunity cost of interplanting coffee with bananas ought to be pointed out to facilitate the work of those engaged in extension work. Effective extension advice must teach farmers how to handle values. This omission of economic aspects of research findings is, however, a reflection of staffing composition; which

1. Research Report, 1961, Coffee Research Station Lyamungu, and Coffee Research Services, Tanganyika (Coffee Board, 1962) p.37

continues to emphasize the importance of technical agriculturalists and agricultural scientists and excludes agricultural economists.

Another research finding relevant to this discussion, is that the single-stem pruning system on Arabica Coffee produces much lower yields than would have been obtained from the multiple-stem system. For all practical purposes, farmers use the single-stem system , dispite the fact that it is a difficult one and requires skilled operation. Interplanting coffee with bananas, at least with the traditional spacing of 9'x 9 for Arabica Coffee, largely precludes the choice of a pruning system. Additionally, the adoption of the multiple-stem system depends on the ability of the farmer to stand some loss of revenue. With the multiple-stem system, trees have to be stumped after some years of bearing, pending production from new shootings.

Often one hears that the failure of small farmers to accept advice which may be both technically and economically sound is in the main due to the farmer's inability to finance such improvements. Unlike the Indian peasant who lives and dies in debt, many a Tanzanian peasant still has a morbid fear of credit, even from government-backed lending institutions. Frequently, the fear is that in the event of his inability to repay the loan, his land and house may be confiscated. To this may be added the mental conditioning by old colonial laws which deterred lending money to Africans by not providing for legal action to be taken by the lender against the borrower in case of default. In churches too, living in debt was thoroughly condemned. Yet it is an acknowledged fact that credit is an important way to prosperity and development. The Cooperative Division of the Ministry of Agriculture thus has an important job to re-condition the farmers' thinking with regard to agricultural credit.

(B) <u>The Economics of Growing Arabica Coffee on Small holdings in Kilimanjaro and Meru - An Estimation.</u>

Lack of farm records is a familiar problem to students of the rural sector of low income countries. To get an insight into what is going on in peasant farming, a number of research methods have been evolved and employed. It is beyond the scope of this paper to analyse the merits and de-merits of each method. Suffice it to say that the choice of a method depends upon resources available to the researcher, including time.

This is not a historical study. It is a study intended to throw some light on the future of coffee cultivation as an enterprise. It is a costing exercise, closely based on current smallholder practices regarding important coffe operations in the areas chosen as discerned from results of a small questionnaire. Costs are given at all levels in 1967 prices. Thirty farmers were interviewed on current coffee growing practices, twenty from Kilimanjaro (divided equally between Marangu and Machame), and ten from Ngyami area in Meru[1]. The writer was taken around the areas by a member of the field staff of the Agricultural Extension Divisions during interviews which lasted about an hour. Random sampling proved impossible and was abandoned. To alleviate this shortcoming, it was ensured that farmers were drawn from a wide area. An attempt was made to strike a balance between progressive and ordinary farmers by

1. See Appendix A for results.

The value of the manure is difficult to estimate. Farmers are required to use cattle or farm yard manure at the rate of one debe (4 gallon tin) per 2 x 2 feet planting holes, mixed with the excavated top soil. In practice, good farmers in these areas apply a half of the recommended rate of manure, and ordinary farmers heed the recommendation even less. The manure usually comes from the farmer's own stall-fed cattle. In this study, the problem of estimating the value of manure was overcome by using costs incurred by Cooperative Union nurseries which raise seedlings for all farmers. Cattle keepers in lower areas sell manure at Shs. 10.00 per lorry, estimated to be one hundred debes. Transporting the manure over an average distance of 10-15 miles costs Shs.15.00, giving a total manure value of Shs.25.00 per lorry. In the light of current small holders practices, about three lorries would be required per acre. Thus was arrived the manure value of Shs.75.00 per acre. The cost of application is not included.

Purchase of Seedlings

Nurseries in these areas are run with Cooperative Union money and Ministry of Agriculture Extension staff give technical advice. Seeds of proven strains are obtained from the Coffee Research Station, Lyamungu. The Unions in these areas have different ways of charging for seedlings. The Kilimanjaro Native Cooperative Union (KNCU) charges a nursery levy of ½ a cent per pound sold by every member, and issues seedlings "free". On the other hand, the Meru-Arusha Cooperative Union (MACU) charges 10 cents per seedling issued to its members. It is reckoned though, that the actual cost of raising a seedling is around 35 cents. For the purpose of this exercise, taking the more straightforward case of the cash outlay for seedlings required of the MACU farmer, Shs.54.00 would be required to obtain sufficient seedlings for one acre.

Planting

The actual planting itself costs 10 cents per seedling planted, or Shs.54.00 per acre if outside labour were employed on a piece-work basis.

Cutworm Control

Immediately after planting, it is recommended that Dieldrin emulsion be applied to the stem and surrounding soil to protect the plant from cutworm, ants, and other soil-living insects.[1] The recommendation is ¾ pint Dieldrin mixed with 4 gallons of water. A pint of Dieldrin cost 10.50 at the time of the survey[2], and as it is unlikely that smallholders would heed the recommendation to the last detail, it is here assumed that one pint would be purchased. The further recommendation that the application should be repeated after six months is generally ignored. The cost of application is again not known.

1. J.B.D. Robinson (ed) A Handbook on Arabica Coffee in Tanganyika (Tanganyika Coffee Board, 1964) p.26

2. Fisians Price List 1966, effective from 1st May, 1966 (Fisians Tanzania Limited, Morogoro) p.1

interviewing five of each in every sub-district covered. However, the distinction between progressive and ordinary farmers depended on the judgement of the accompanying member of the Extension staff. Farmers were visited once only.

In addition to the general questionnaire, a smaller sample was taken of eight farmers to assess costs of establishing a coffe bush up to the fifth year after planting[1]. The questions on this were rather too many to be carried out on a large scale as farmers are often bored when such is the case. The Liason Officer, Coffee Research Station, Lyamungu, and District Agricultural Officers were consulted as a counter-check.

I. Estimated Costs of Establishing and bringing on acre of Arabica Coffee into bearing.

The study was made a little easier by the fact that farmers, hesitant to impute a value to farming practices, preferred to express costs in terms of payments to casual labour paid by task, were they to employ any. No value has been assigned to land, which is usually inherited or portioned out to sons according to customary laws. Coffee is interplanted with bananas in these areas.

Land Preparation

The amount of expenditure on this item depends on the condition of the land before work commences. For the populous areas of Kilimanjaro and Meru where land is in relative shortage, most of it has been taken up; and land preparation in the sense of clearing on indiginous forest does not arise. However, deep rooted perennial grasses, such as couch grass, may require special eradication measures. On a task basis, casual labour is paid Shs.50 to prepare an acre of land.

Marking-out and Holing

Marking-out is important because digging holes and re-filling holes are necessary operations before the actual planting takes place, and some method of demarcating the central position of holes is helpful. Pegs are used. Holing includes digging of round holes about 2 feet deep and 2 feet in diameter at intervals of 9' x 9, - the traditional spacing for Arabica Coffee which gives about 540 trees per acre. Many ordinary farmers do not heed these requirements precisely. As a general practice, piece-work casual labour is paid 25 cents per hole. This gives Shs.135.00 per acre.

Re-filling

About one month before planting is due, the holes are re-filled with a mixture of top soil and well-rotted compost or cattle manure. Cattle manure is the more commonly used. The operation is not as simple as it sounds, and is best carried out in two or three stages, each on a differenct day, to ensure that the soil is well consolidated[2]. A charge of 5 cents per hole is made, or Shs.27 per acre.

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1. See Appendix B for results
2. A Standbook on Arabica Coffee in Tanzania (ed) J.B.D. Robinson

Infillings

Not all seedlings planted will survive, and about 10 - 15 replacements per acre might be required. This is really important in the first two years only. It is here assumed that this might cost Shs. 10.00 to carry out all the required operations[1].

Purchase of Coppes Spray Pump

A sprayer (Cooper's Pegles No. 9) costs Shs.200.00 There are a few cases where a small number of neighbouring farmers came together and bought one to share among themselves in rotation on a mutual understanding. Others depended on borrowing from neighbours.

Mulching

This operation is recommended to be applied on strips rather than as a complete cover. Mulching conserves soil moisture, reduces soil erosion and water run-off, increases rainfall acceptance, humus and adds soil nutriets, reduces soil temperatures and supresses weeds. All this should lead to improved growth of the coffee plant and high yields, given normal weather conditions. In Kilimanjaro and Meru, smallholders interplant coffee with bananas and use banana trash for mulch when they attend their banana crop. Thus mulching as a coffee cultural operation is coincidental, rather than a organised operation. However, if hte operation were carried out once a year after the long-rains as recured, it is reckoned 4 mondays would be required[2]. At shs.3 per day, which is the current rate of pay to outside labour in these rural areas, Shs 12.00 would be the cost per acre. No way could be devised to estimate the value of the mulch.

Weeding

On smallholdings, weeding is a hand-cultivation operation, carried out with a hoe. There are two kinds of hoes used, the spade hoe or "jembe" and the fork hoe or "rato" In the lower areas, weeding is done less often compared to the wetter upper belt. The pattern of weeding is deep ploughing using fork hoe in January, spade hoe in April, a slashing in May-June, another fork hoe cultivation in July-August, hoe cultivation in September-October, and a second slashing in November-December. Fork hoe cultivation is usually used where couch grass is common. It costs Shs.50.00 per acre, as compared to Shs 40.00 for the spade hoe cultivation. Four spade hoe cultivations are assumed for the purpose of this exercise.

Fertilizers

Nitrogen deficiency is the most widespread and serious nutrient deficiency in many coffee growing areas of Tanzania[3].

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1. The average from 4 farmers who mentained the operation is Shs.11
2. Lieson Officer, Coffee Research Station, Lyamungu.
3. A Hand-book on Arabica Coffee, p.68.

For smallholders in the northern area of Tanzania, the recommended basal rate of Nitrogenous fertilizers application is 3 ounces of Ammonium Sulphate Nitrate per tree per application, three times in a season in November, March, and June[1]. Many an ordinary farmer limit its application to weak trees after a heavy crop. Those who use it more regularly apply two times instead of the recommended three times. However, additionally they use cattle manure.

Ammonium Sulphate Nitrate stood at Shs 12.65 per 25 lb bag at the time of the survey[2]. Two applications at the rate of 3 ounces per tree amount to about 4 bags of 25 lbs each per season. This would cost the farmer Shs 50.60 per acre per season. The cost of application is not included, nor the cost of transporting the fertilizer from town to the farmer's locality, usually in a local bus. If the land being developed for coffee was former arable land, it would be fertile enough in the first three years after planting and artificial fertilizers would be used beginning with the fourth year.

Disease Control

One of the most important methods of disease control is by the application of furgicides. In addition to improving leaf retention and stimulating leaf growth, the use of Copper Sulphate has the further advantage of controlling Leaf Rust. Five pounds of 50%. Copper Sulphate in 24 gallons of water, applied five times a year is recommended. All farmers interviewed applied copper, a half of them five times as required, a few six times, and the rest two, three or four times[3].

The National Development Credit Agency now provides loans to Sooperative Societies through their Unions for chemical purchases, and buys these in bulk at discount prices for the Unions which in

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1. Lyamungu Planters Day: Field town of the Coffee Research Station 1st November, 1966. p.3
2. Tanga Chemicals, Retail Price Lest, 1966, Tanzania. (Tanga Chemical Industries Ltd. Dar es Salaam, June,1966)
3. See Appandix A.

turn distribute then to their societies. Table 1 shows costs of all the important chemicals for coffee as charged to members of the MACU in 1966/67 season.

TABLE I. Meru - Arusha Cooperative Union Costs on Coffee Sprays, 1966/67

Cost to Union and farmer	Copper (Shs/ton)	Sumithion (Shs/gallon)	Dieldrin (Shs/gallon)
Cost to Union [1]	6680.00	83.50	73.00
% Interest at 12 months period [2]	535.00	7.00	6.00
Cost of farmer	7215.00	90.50	79.00
or	181.00 per 56 lb bag	11.50 per pint	4.00 per 802 tin
or with	5 applications x 5 lbs each per acre	2 applications x 1.5 pints each per acre	4 pints per acre
=	15.00 per 100 trees	6.40 per 100 trees	7.35 per 100 trees

Source: National Development Credit Agency

Note 1 Price f.o.r. Dar es Salaam, plus freight to Union and insurance

2 Interest at 8 percent to the farmer covers the Credit Agency's charge of 5¼ percent and Union costs.

Five copper applications at 5 lbs each time would cost the farmer about Shs.81.00 in a season, excluding the cost of application and depreciation of sprayers. More copper might be required in future if it became necessary to spray against the Coffee Berry Disease.

Pest Control

Though the coffee tree is a host to over 150 species of insects[1], the important coffee pest in northern Tanzania are Antestia, White stem Bores, and Berry Moth. Thrips are less important now than they were in the past;

1. A Handbook on Arabica Coffee, p.142.

For control of Antestia, either Dipterex or Sumithion is used. But lately, and for a good reason, farmers' preference has been for Sumithion though it is a little more expensive than Dipterex. Apart from controlling Antestia, Sumithion controls Leaf Miners and Berry moth at the same time. Though three applications are recommended, smallholders apply two times, using 1½ pints each time per acre. At Shs.11.50 per pint of Sumithion to the farmer[1], Shs 34.50 is the required cash outlay per acre.

White Stem Borer is controlled by using Dieldrin at 4 pints per acre, usually when the disease is detected or once in two or three years to prevent re-investation. 'Four pints cost the farmer Shs 39.50. To avoid inflating the costs of any one year with this expenditure which is not certain to fall on any one year, costs have been distributed almost equally from the third year after planting to the fifth year. In the upper coffee belt, the pest is less common and spray against it less vital. Chapter 13 of the laws of Tanzania and rules made under that ordinance declare White Stem Borer and Antestia as pests which must be controlled.

Pruning

Pruning and the training of coffee trees is probably the most abused of all the most important operation connected with coffee culture. Smallholders use the single-stem system on the whole. There is no real pruning in the first two
/years after planting, except capping for storey formation. The main pruning starts in the third year after planting. This is an important operation as it lays the pattern of the tree's future production, and a charge of 10 cents per tree is made. There are trained teams in pruning who offer their services to those who wish to be assisted in this operation. After the third year, pruning is 5 cents per tree. In a season there is carried out one main pruning and a second light pruning, called "handling" Only the main pruning is considered here.

1. See table I.

Picking

The first few berries appear when the bushes are two years old, but the second year's "flying crop" is not reckoned as the first crop because yields are very law. Not until the third year can one speak of a real first crop.

Picking season is a very busy time for farmers and their families. Here, the farmer usually requires the assistance of outside labour, especially now with central pulperies whose management insist on a degree of ripeness that is just right. Outside labour is paid Shs. 1.00 per debe (4 gallon tin) of cherry, plus free lunch and free local beer or "pombe". Usually these are other coffee farmers, who are able to work for others because coffee picking stretches from June to December, the crop ripening first in the lower belt, then middle belt, and finally upper belt of the mountain sides.

Transport

Often the crop is transported to society store on headload, but at times farmers hire transport and pay on average Shs. 1.00 per bag. Two or three of KNCU's Societies have lorries and tractors and collect cherry coffee from known points for onward transmission to the society.

Processing

It is difficult to estimate processing costs since some of the farmers use central coffe pulperies and need only deliver cherry coffee, while others process the crop themselves at home. The latter would need to buy a hand-pulper, wire trays, provide the processing labour, and act as his own watchman. By an oversight, this item of expenditure was not included in the questionnaire. However, the seriousness of this omission is reduced by the general movement towards the use of central coffee pulperies.

TABLE 2

Estimated Coffee Establishment And Maintenance Costs
(Shs. per acre)

Establishment Costs		Maintenance Costs	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
Land preparation	50.00	Mulching (Labour)		12.00	12.00	12.00	12.00
Marking & Holing	135.00	Weeding	120.00	120.00	120.00	120.00	120.00
Re-filling	27.00	Fertilizers(ASN 267.N)				56.60	56.60
Manure (Value)	75.00	Pruning	-	-	54.00	27.00	27.00
Planting	54.00	Pest Control		-	47.50	47.50	48.00
Cutworm Control	10.50	Disease Control(Copper)			81.00	81.00	81.00
Copper Spray Pump	200.00	Picking	-	-	36.00	72.00	117.00
Infillings	10.00	Transport			6.00	12.00	19.50
Total	615.50		132.00	132.00	365.50	428.10	481.00

A Comment on the costs

Though the above estimates of coffee production costs have been largly based on employed outside labour, the typical Chagga and Meru farmer cannot be decribed as a genteman farmer. For him, most of these costs would not arise since he is unlikely to employ outside labour except at the peak picking season. It is therefore appropriate to show estimated costs of coffee production in the alternative case of minimum cash outlay and unpaid family labour inputs.

TABLE 3

Estated Coffee Establishment And Maintenance Costs
Alternative of Minimum Cash Outlay and Unpaid Family Labour.
(Shs. per acre)

Establishment Costs	Shs	Maintenance Costs	Yr1	Yr2	Yr 3	Yr 4	Yr 5
Land Preparation	-	Mulching	-	-	-	-	-
Marking & Holing	-	Weeding	-	-	-	-	-
Re-filling	-	Fertilizers	-	-	-	56.60	56.60
Purchase of Seedlings	54.00	Pruning	-	-	-	-	-
Manure (Value)	75.00	Disease Control (Copper)	-	-	81.00	81.00	81.00
Planting	-	Pest Control	-	-	47.50	47.50	48.00
Cutworm Control	10.50	Picking	-	-	-	-	-
Infillings	10.00	Transport	-	-	-	-	-
Copper Spray Pump	200.00						
Total	341.50		-	-	128.50	185.10	185.60

Yields

Yields for the third and fourth years after planting closely correspond with those from case studies, with minor adjustments suggested by those whose daily duty is to assist coffee farmers in their problems. Yields for the fully established fifth year crop are an average for 1966/67 results of a questionnaire covering 30 farmers, and results from case studies. It was felt that case study results were from too few observations to be preferred alone.

2. Gross Margin Returns to the farmer

Returns to the farmer depend on yields, the price realised in world markets, marketing efficiency, non-marketing deductions, and level of government taxation. Payments to Kilimanjaro Native Cooperative Union members for the three seasons 1963/64 - 1965/66 averaged 1.78 cents per pound parchment. The period cited is characterised by the introduction of the 5 percent Development Levy and 5 percent ad volorem District Council cess. It may be thought that now that the Levy has been withdrawn and the cess reduced to 1 percent ad valorem, returns to the farmer would rise. This is not exactly so.

At the time the levy was withdrawn, the export tax was raised from £22 per ton to £28 per ton for mild Arabica. Secondly, until June, 1967, government refunded the export tax of £28 per ton for coffee exports to non-quota markets. From the Board's £40 rebate for such exports, the farmer bore the difference above the export tax, or £12 per ton only. But now that non-quota exports have been included in the tax-net, the farmer will shoulder the whole rebate cost. Thirdly, cooperatives are increasingly becoming indebted to the National Development Credit Agency through loans for spray programs and the construction of central coffee pulperies. This should raise deductions at the society.

Future returns to the farmer have therefore been estimated at slightly lower level of Shs. 1.75 per pound parchment, or Shs 196.00 per hundredweight. It might be argued that lower prices should be quoted to take care of any future falls. The establishment of floor and ceiling prices for various types of coffee under the ICA apart, the effect of the proposed new higher basic quota for Tanzania should mean reduced sales to the low-priced non-quota markets[1].

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1. It is proposed to increase Tanzania's basic quota from 435,485 bags to 700,000 bags when the ICA is extended in September, 1968.

TABLE 4

Estimated Gross Margins/Acre of Arabica Coffee

(Shs. per acre)

Case of Paid Outside Labour	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Accumulation Total & Overall GM
Yields - Parchment Cwts.	Nil	Nil	2	4	6.5	12.5
- Cherry equivalent	Nil	Nil	6	12	19.5	37.5
Receipts/acre (at Shs. 196/- per cwt	Nil	Nil	392.00	784.00	1274.00	2450.00
Direct Costs/acre	132.00	132.00	356.50	428.10	481.10	1529.00
Gross Margin/acre	-132.00	-132.00	+35.50	+335.90	+ 793.00	+ 920.30
With Unpaid Family Labour						
Receipts/acre	Nil	Nil	392.00	784.00	1274.00	2450.00
Direct Costs/acre	Nil	Nil	128.50	185.10	186.60	499.00
Gross Margin/acre	Nil	Nil	+263,50	+598.90	+1087.40	+1950.80

For a perennial crop like coffee, the profitability calculations presented above are not a true guide for decision-marking purposes, because costs are incurred over a different period of time than that in which revenues are received. There is thus the question of deferred returns.

Discounted Cash Returns

The annual gross margins depend to a large extent upon the discount rate used. In this study, the rate of interest of 8 percent used is that at which the cooperatives borrow money from the National Development Credit Agency. An assumption follows, that the rate of the farmer's personal discount is equal to the rate of interest at which he borrows capital credit. To emphasize the difficulties for the man on the land in obtaining credit, a higher discount rate of 15 percent has also been used.

The annual gross margins cash flows in the case of unpaid family labour will have a summed present value of:

	GM Cash Flow		8% Discount rate p.a.	P.V.	15% Discount rate p.a.	P.V.
Year 1	0	x	$\frac{1}{(1.08)}$ ..... =	0	0 x $\frac{1}{(9.15)}$ ..... =	0
Year 2	0	x	$\frac{1}{(1.08)^2}$ ..... =	0	0 x $\frac{1}{(1.15)^2}$ .... =	0
Year 3	263.50	x	$\frac{1}{(1.08)^3}$ ..... =	209.17	263.50 x $\frac{1}{(1.15)^3}$ =	173.25
Year 4	598.90	x	$\frac{1}{(1.08)^4}$ ..... =	440.19	598.90 x $\frac{1}{(1.15)^4}$ =	342.45
Year 5	1087.40	x	$\frac{1}{(1.08)^5}$ ..... =	740.08	1087.40 x $\frac{1}{(1.15)^5}$ =	540.66
Summed present value				Shs.1389.44	Shs.	1056.36

Similarly in the case of paid outside labour, the summed present value of the annual gross margins would be:-

At 8% discount rate p.a.	At 15% discount rate p.a.
Shs.814.79	Shs.609.69

3. Present Net Worth of Investing In Coffee Growing

The fifth year after planting can be regarded to stand for a fully established coffee crop. In this study, it is assumed that thereafter, yields and returns from coffee remain constant throughout the economic life of coffee trees[1]. The life of coffee trees is estimated to be 50 years. At the suggested prices paid to coffee farmers and fifth year onwards constant yields, the present stream of cash margin flows in the case of unpaid family labour is obtained by multiplying the uniform gross margins by the following formula:-

$$V = a\left[\frac{1-(1+2)^{-n}}{2}\right]$$

$$= a\left[1-\frac{(1+0.08)^{-50}}{0.08}\right]$$

= 1087.40 x 12.2335 (tabular value of 50 years at 8% p.a.)

Less First five years discounted summed present value

= 13,302.71 - 1,389.44

Present Net Worth = Shs 11,913.27 (at 8% discount rate p.a.)

Or = Shs 7,242.63 - Shs 1056.36 (at 15% discount rate p.a.)

= Shs 6,186.27

Similarly, in the case of paid outside labour,

PNW = Shs 8,886.38 (at 8% discount rate p.a.)

Or = Shs 4,672.09 (at 15% " " ")

Put in another way, with unpaid family labour inputs, the farmer can expect a constant gross margin flow per acre of Shs 238.26 a year at 8 percent discount rate per annum, and Shs. 144.85 at 15% discount rate. With an average holding of 3 acres, this gives a discounted constant household income of just over Shs 700 in the first alternative. In the case of paid outside labour, the annual discounted gross margin flow would be Shs 177.78 at 8 percent discount rate per annum, and Shs 93.44 at 15 percent discount rate.

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1. This is a rather simplified assumption, as one would expect yields to rise for some years, remain constant for a period, and then fall off as the trees grow old.

The aim of this analysis is not to discuourage a policy of maintaining or increasing the level of coffee production through new plantings or replacements, but to show the importance of discounted returns in this type of enterprise. A major weakness of using gross margin cash flows is that these do not give an immediate guide as to whether it is the farm system which needs to be changed or production policy that ought to be geared to improving efficiency of production. In addition to the gross margins analysis, programme planning would be required. This is beyond the scope of the present study. Further, the results just presented do not take into account year - to - year variations of weather, which affects factor inputs, yields, and profits.

These returns correspond to Keynes "prospective yields," in that they are net of operational costs, but do not include depreciation. Partly owing to the long life of the coffee tree, provision for depreciation has been omitted as it plays an insignificant part in the long-term costs of the enterprise. Returns to the farmer would be slightly reduced in the Tanzanian setting where the farmer experiences a time-lag in receiving his payments. Social returns, which are returns to the farmer plus all taxes, would of course be higher than returns to the farmer.

The findings in this study point that it remains profitable to grow coffee. But the nature of this single-study enterprise is unable to reveal the opportunity costs of the factors of production in alternative employment. In view of the tendency for coffee prices to fall, farmers, who in the past have been showing great interest in their returns from coffee, will in future have to show increasing interest in their costs.

The study proceeded along the steriotype lines of research, emphasizing returns to land. It is recognised that in some instances factors such as the availability of family labour may be the more limiting consideration. However, the seriousness of pursuing this line of research is reduced by the fact that the areas covered are densely populated and land litigations are frequent.

The techniques used here in evaluating the profitability of coffee growing do not increase the validity of the raw statistics. It is realised, for example, that frequent visits to farmers would have reduced the recording error, which is greater with single visits. But it hoped that those results will help in clearing some problems of the coffee industry. Until more than estimates of coffee production costs come forth, these findings stand to be proved right or wrong.

APPENDIX A

Summary of Some Results From Questionnaire On Farm Practices

Farm No.	Acreage Under Coffee	1966/67 Yields (Cwt)	Copper Sprays	Artificial Fertilizer	Weeding	Employed outside Labour	
						Permanent	Seasonal (Picking)
1	1.5	5.0	x 3	Nil	x 4	Nil	Nil
2	3.0	15.0	x 5	x 1	x 3	Nil	Yes
3	4.0	25.0	x 5	x 3	x 3	Nil	Yes
4	2.5	6.5	x 3	Nil	x 6	Nil	Yes
5	4.0	9.0	x 4	Nil	x 3	Nil	Yes
6	2.0	10.0	x 2	Nil	x 4	Nil	Yes
7	3.0	45.0	x 6	x 3	x 3	Nil	Yes
8	3.0	30.0	x 5	x 3	x 3	Nil	Yes
9	1.0	9.0	x 5	x 2	x 6	Nil	Nil
10	2.0	17.0	x 5	x 3	x 3	Nil	Yes
11	3.0	40.0	x 5	x 3	x 4	Nil	Nil
12	9.0	65.0	x 5	x 3	x 3	Yes	Yes
13	2.5	13.5	x 5	x 2	x 2	Nil	Yes
14	4.0	15.0	x 5	Nil	x 2	Yes	Yes
15	3.0	13.5	x 4	Nil	x 3	Nil	Yes
16	6.0	6.0	x 2	Nil	x 3	Yes	Yes
17	2.0	11.0	x 3	x 1	x 3	Nil	Yes
18	2.5	10.0	x 2	x 3	x 2	Nil	Yes
19	3.0	25.0	x 5	x 3	x 6	Nil	Yes
20	4.0	16.0	x 2	Nil	x 3	Nil	Yes
21	1.5	5.0	x 4	Nil	x 2	Nil	Yes
22	8.0	48.0	x 5	x 3	x 4	Nil	Yes
23	2.0	7.0	x 2	Nil	x 3	Yes	Nil
24	2.0	7.0	x 1	Nil	x 2	Nil	Yes
25	3.5	14.0	x 3	x 1	x 2	Nil	Yes
26	2.0	20.0	x 5	x 2	x 3	Nil	Yes
27	1.5	9.0	x 6	x 1	x 4	Nil	Nil
28	1.0	8.0	x 5	x 2	x 3	Nil	Nil
29	1.5	20.0	x 5	x 3	x 3	Nil	Nil
30	4.0	50.0	x 5	x 3	x 3	Yes	Yes
Total	92.0	574.5	122	45	98		
Average	3.07	6.23	x 4	x 1.5	x 3.3		

APPENDIX B

Results From Questionnaire On Production Costs And Yields
Case Studies

(Shs. per acre)

Initial Devt. Costs	Farm No.	1	2	3	4	5	6	7	8
Land preparation		40	50	40	50	50	50	35	50
Marking & Holing		162	135	145	135	136	196	135	124
Re-filling		27	24	27	27	28	28	24	30
Purchase of seedlings		54	54	"free"	54	"free"	"free"	"free"	54
Manure (Value)		n.a	n.a	n.a	25	n.a	50	30	100
Planting		54	24	44	18	54	54	44	54
Cutworm Control		10	8	-	-	12	-	-	15
Total		347	295	256	309	280	298	288	327
Maintenance Costs, Yr 2									
Weeding		130	135	84	120	80	130	120	240
Mulching (Labour)		28	12	28	n.a	21	24	n.a	n.a
Fertilizers		-	94	-	-	30	-	24	-
Disease Control		-	-	40	-	25	-	-	45
Pest-Control		45	-	35	-	-	-	40	50
Pruning		-	-	-	-	-	-	-	-
Total		203	171	187	120	156	154	184	335
Maintenance Costs, Yr 3									
Weeding		130	135	84	120	80	130	120	240
Mulching		28	12	28	n.a	21	24	n.a	n.a
Fertilizer		25	-	30	-	-	25	-	-
Disease Control		85	70	86	85	75	71	87	70
Pest-Control		-	50	-	45	40	35	-	-
Pruning		35	54	81	54	36	54	54	24
Total		303	321	309	304	252	339	261	334
Maintenance Costs Yrs 4-5(a)									
Weeding		130	135	84	120	80	130	120	240
Mulching		28	12	28	n.a	21	24	n.a	n.a
Fertilizers		45	30	40	-	-	35	-	75
Disease Control		85	70	86	85	75	71	87	70
Pest-Control		45	50	35	45	40	35	40	50
Pruning		35	54	81	54	36	54	54	24
Total		238	351	354	304	252	349	291	459

Note: These Costs do not include purchase of spray pump.

SUMMARY OF RESULTS ON YIELDS

(Cwts/acre)

Farm No.	Yr 3	Yr 4	Yr 5
1	2	3	5
2	2	4	8
3	3	6	8
4	2	3	6
5	2	4	5
6	2	3	6
7	2	3	8
8	3	5	10
Total	18	31	55
Average	2.25	3.9	6.9

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