THE GOVERNMENTS OF MALAYSIA AND THE STATE OF JOHOR

COCONUTS

WORKING PAPER

JOHOR TENGAH AND TANJONG PENGGERANG REGIONAL MASTER PLAN

1971

HUNTING TECHNICAL SERVICES LTD.

BINNIE & PARTNERS

OVERSEAS DEVELOPMENT GROUP
UNIVERSITY OF EAST ANGLIA

SHANKLAND COX OVERSEAS

COCONUTS

WORKING PAPER

COCONUTS

CONTENTS

TABLES

APPENDIX A

MARKET PROSPECTS

TABLES

APPENDIX B

COCONUTS ESTATE PRODUCTION

TABLES

APPENDIX C

COCONUTS - SMALLHOLDING PRODUCTION

TABLES

WORKING PAPER

COCONUTS. 12th April, 1971

1. PRODUCTION

1.1. Environment

1.1.1 Climate

Growing conditions are generally suitable. The minimum annual rainfall required (60 inches) and the minimum monthly requirement (5 ins) are more than satisfied. Temperature, humidity and sunshine hours are satisfactory. The project area does not suffer from gale force winds. A possible climatic limitation could be excessive rainfall, causing interference with pollination and photosynthesis.

1.1.2 Soils

The nutrient status of all the project area soils is low. Yields comparable with those obtained on the coastal marine clays will require heavier application of fertiliser. The raised beach sands of the Tanjong Penggerang coast are particularly free draining and infertile, and would require such frequent and high fertiliser application that they are regarded as not worth development. The beach swales are peaty, and are unsuitable for the crop.

The tall and semi-tall palms are tolerant of a wide range of soil textures, and provided that areas with hardpans and areas subject to waterlogging and consequently to inadequate aeration are avoided (or drained), the Rengam and similar soils of the project area should be satisfactory for production under good management.

1.2 Palm Types and Yield Potential

In West Malaysia dwarf coconuts bear earlier and yield more than tall types; they however, are much more demanding in their ecological requirements, and are less suitable for planting on inland soils. Seed nuts produced from carefully selected mother palms (talls) and planted on inland soils in the project area could be expected at best, and under good management, to yield as follows:-

Age (years)	Yield Dry Copra (lb/acre)
5-6	80
6-7	200
7-8	800
8-9	1,200
9-10	1,500
10-11	1,800
11 and on	2,200

Recent work in the Ivory Coast has resulted in the production of high yielding hybrids from crosses between repeatedly inbred lines of semi-tall West African palms (males) and Malaysian dwarf palms (females). In the Ivory Coast the most recent yield of these crosses is said to be:-

Age (Years)	Yield (lb/acre)
4-5	266
5-6	1,600
6-7	3,066
7-8	3,600
8 onward	not yet known - probably not more than 3,600.

In Cambodia recently introduced hybrids are said to be doing as well as in the Ivory Coast on coastal type clay soils with a very shallow water table (similar to some Malaysian soils). However the Malaysian dwarf itself is doing equally well under these conditions. The value of the hybrid to Malaysia would be if it combined the yielding capacity of the dwarfs with the environmental adaptability of the talls.

1.3 Cultivation

1.3.1 Intercropping

Intercropping is desirable in the first years to produce income before the palms come into bearing. Many crops have been tried for the purpose, e.g. vegetables, tapioca, maize, pulses, groundnuts, yams, sweet potatoes, pineapples and bananas. More trials are required to establish the most suitable ones for south Johor conditions and to find out the best way to grow them in combination with the main crop. It should be remembered that the palm's feeding roots are in the surface layers of the soil; thus crops that require the least amount of soil disturbance may be more satisfactory than ones requiring frequent intercultivation. Pineapples and cassava may be the most immediately suitable. Whatever crop is used it is imperative that adequate extra fertilisers be added to provide for the full requirements of both the palms and the inter-crop and to prevent the exhaustion of the soil.

As the palms grow their shade will progressively eliminate the above crops. They may be replaced by pasture for grazing by cattle or by shade tolerant crops such as cocoa and bananas. The extensive use of cocoa will depend on it being suited to the Rengam and Harimau soils and of bananas on the discovery of suitable cultivars for the export market. Pasture could be the most widely useful crop but the combination might cause water still and reduce the yield of coconuts. The yield of

the pasture will certainly be reduced by the shade of the trees. At a light intensity of about 50 per cent a stocking rate 3/4 of a beast per acre would be realistic.

1.3.2 Fertilisers

High yields of nuts may require something of the order of 8 lb. of fertiliser per tree per year. At 60-70 trees per acre this will be a major item of the cost of production, and it is important that the applications used should be founded on a sound basis. Fortunately foliar analysis is an established technique for determining the macro and some of the micro nutrient requirements of the crop, and application should be based on analyses of samples taken from leaf nine for the first four years and from leaf fourteen thereafter. Critical levels in these reference leaves have been established with adequate precision for nitrogen, phosphrous, potassium, calcium, magnesium, iron and manganese.

1.4 Main Products

Besides fresh coconuts there are three main products, copra, toddy and desiccated coconuts.

1.4.1 Copra

Good quality copra should be clean, sweet smelling, contain not more than 6 per cent moisture and between 65 and 69 per cent oil. In this condition it will resist attack by micro organisms, lose little weight in storage, and yield an oil with a low free fatty acid content.

To obtain such a product the kernel must be kept clean and free of abrasive contaminants and dried as soon as possible after exposure, preferably within 24 hours. The project area has an unsuitable climate for sun drying and drying in dirty smoke is not desirable. It is recommended that hot air driers be used. Small driers, suitable for individual owners, can be home-made. Drying on the farm can maximise the return to the producer, but may result in the production of under-dried copra unless a mandatory grading system is introduced.

Large centrally located driers provide good quality control, facilitate the use of by-products and can lead to wider cooperative activity. The main disadvantages are (a) greatly increased transport requirements, (b) the removal of large quantities of useful organic matter from the farms and (c) easier disposal of stolen nuts.

1.4.2 Toddy

Some 500 acres are devoted to experimental toddy production at Kuala Bernam estate, Perak.

1.4.3 Desiccated coconut

Considerable interest is being shown at present in this commodity. An economic scale factory could probably require an input of the order of at least 1,000,000 nuts per month.

1.5 By-products

The two main by products of copra production and desiccated coconut manufacture are coir and shell charcoal.

1.5.1 Coir

Coir is extracted from the mature husk by hammer-milling. The value of the product is limited by its short staple length, but it finds outlets in upholstery and packing. It is frequently used with rubber bonding to form moulded and sheet packing material and to make very good, cheap mattresses.

1.5.2 Shell charcoal

Shell charcoal can be a convenient source of activated carbon, for which there is a considerable demand for use in gas-masks and other absorptive devices and in sugar refining. Some 20,000 shells are required to produce one ton of activated carbon.

2. MARKET PROSPECTS

Although the coconut palm produces numerous products of dietary, domestic and industrial use, coconut oil, which is obtained by crushing of copra, is by far the most important. This oil is used in the manufacture of margrine and cooking oils, soaps, fatty alcohols, plasticizer, degradable detergents and explosives. The special properties that determine its value are very largely shared by palm kernel oil and in assessing future demand the two products must be considered together, since both are produced in Malaysia at present, and palm kernel oil production will certainly increase in relative importance in the next twenty years.

2.1 Domestic Market

The local market analysis, given in detail in Appendix A, is largely based on conjecture. There are no production data available for palm kernel oil, and those for coconut oil may be subject to wide error, as the bulk of commercial production of coconuts is by smallholders and a considerable and unrecorded part of total production does not reach the market, but is produced in gardens and consumed in the home and local village.

Internal production of copra, based on purchases by local mills, reached 152,000 tons in 1968, yielding some 90,000 tons oil. According to the FAO Economic Survey of the Coconut Industry (1968) production in West Malaysia has been virtually static for the past 20 years. In the absence of any large replanting and/or new planting programmes it seems unlikely that there will be any significant increase in the next two decades.

Estimates of present production of palm kernel oil have been made based on the apparent disapperance of palm kernels and on the assumption that kernels on crushing yield 45 per cent of oil. Future production is based on an assumed future planting rate of 50,000 additional acres a year.

Internal demand for coconut and palm kernel oil together has been projected to rise from about 78,000 tons in 1970 to 193,000 tons by 1990. Table 1 shows the projected internal supply and demand from 1970-1990.

TABLE 1 PROJECTED INTERNAL OF SUPPLY AND DEMAND FOR COCONUT AND PALM KERNEL OILS (TONS).

	Supply			Demand
Year	Coconut Oil	Palm Kernel Oil	Total	
1970	90,000	41,000	131,000	78,000
1975	90,000	82,000	172,000	97,000
1980	90,000	130,000	220,000	122,000
1985	90,000	179,000	269,000	153,000
1990	90,000	225,000	315,000	193,000

The present domestic surplus can be expected to increase throughout the period and large quantities of both copra and palm kernels (or of palm kernel and coconut oils) will be available for export.

2.2 Export Market

World production and exports of coconut, palm kernel oils have been virtually static in the past decade, and their proportion of the world production of all fats and oils and of the trade in them has diminished. This decline in the share both of production and exports has been particularly marked for coconut oil. Although efforts to encourage replanting are being made in several countries it is unlikely that there will be much expansion of trade in the next decade. The major exporter is the Philippines; output in this country has in recent

years been curtailed by typhoons, which are an ever-present and recurring risk. Indonesia, once a major producer and exporter, is now only exporting from a necessity to earn foreign exchange. Domestic consumption is being curtailed, and as condition within the country improve, it is likely that domestic consumption rather than exports will increase. India, a major producer, is endeavouring to meet domestic requirements and is unlikely to become an exporter. Production in Ceylon, formerly an exporter, has fallen recently for numerous reasons, and unless there is a marked improvement, that island is more likely to become an importer than an exporter in the foreseeable future. Japan has been importing coconut products in rapidly increasing quantities in recent years, and appears likely to continue to do so.

It does not appear therefore that there will be any great difficulty in disposing of additional quantities of coconut oil in the next decade or two. Its special chemical properties should ensure its disposal and also help it to resist any declining price trend more successfully than other fats and oils with less specific or luxury uses. For evaluating the future profitability of coconut production prices of coconut oil have been assumed tonbe as shown in Table 2, which also gives the equivalent farm gate price of copra.

TABLE 2 PROJECTED PRICES OF COCONUT OIL (EXMILL) AND COPRA (AT MILL)

	Coconut Oil $/ton	Copra $/ton
1975	820	450
1980	800	440
1985	782	430
1990	765	422

3. ENTERPRISE EVALUATION

3.1 Estate Production

Two coconut enterprise are evaluated in this section, one using selected local seed nuts, the other hybrid planting material. Details of costs and yields assumed are given in Appendix B.

3.1.1 Seedling nuts

For selected seedling plantations the relative importance of the individual items of cost is indicated by calculating their present value. This is shown in Table 3.

TABLE 3 PRESENT VALUE AT 15 PERCENT DISCOUNT RATE OF COSTS - COCONUTS ESTATE PRODUCTION

Item	Present Value of Cost Per Gross Acre+ ($)	Percent of Total
Clearance Roads and Planting	315	22
Fertiliser	216	15
Machinery	33	2
Chemicals	128	9
Housing	80	5
Labour	382	26
Management	122	8
Rent and Other	126	9
Processing	46	3
Transport	9	1
Total	1,462	100

+ Net acreage is assumed to be 85% of the gross acreage.

The largest single cost item is labour, but this makes up only just over 25 percent of the total as compared with almost 40 percent for estate rubber production and indicates the less labour intensive nature of coconut production. The next most important items are fertilisers and chemicals (24%) and clearance and planting (22%).

The overall profitability of coconuts from selected seedlings as an estate enterprise is extremely low, (Tables 4 and 5). The commercial rate of return over a 20 year period is only one percent. Over 30 years a more probable productive life span for coconuts, the internal rate of return rises to five percent. Table 4 also shows the present values at 15 percent discount rate and internal rates of return for a coconut enterprise if rents and premia are excluded as costs (government financial rate of return) and if labour is valued at its shadow wage of $40 per month and housing costs excluded (social rate of return).

TABLE 4 NET PRESENT VALUES AND INTERNAL RATES OF RETURN TWENTY YEARS FOR COCONUTS FROM SELECTED SEEDLINGS

	$/acre
Net Present Value at 15%	
Commercial	- 766
Government financial	- 640
Social	- 306
Internal Rate of Return	
Commercial	1 %
Government financial	3 %
Social	9 %

TABLE 5 SEEDLING COCONUTS ESTATE OPERATION. COSTS AND RETURNS PER GROSS ACRE ($).

Year	Costs	Returns	Cash Flow
1	457		-457
2	119		-119
3	123		-123
4	129		-129
5	129		-129
6	129		-129
7	239	34	-205
8	189	133	- 56
9	193	200	7
10	196	249	53
11	204	297	93
12	205	361	156
13	205	359	154
14	205	358	153
15	205	357	152
16	205	356	151
17	205	354	149
18	205	352	147
19	205	351	146
20	205	351	146

The social rate of return is taken to reflect the real value of an enterprise of this type to the economy at the present time. The internal rate of return of 9 percent is low compared to both rubber and oil palm (18 percent and 24 percent respectively), Other possible crops show social rates of return of 20 percent or more. Thus seedling coconuts as an estate monocrop appear to be of little value as an enterprise in the project area.

3.1.2 Hybrid nuts

Hybrid coconuts if conditions are suitable, may yield about 50 percent more than seedlings selected from present stocks. In addition they are likely to begin yielding in the fifth year after planting compared to the seventh year with currently available strains. These two factors, have a dramatic effect on the cash flows and rates of return, (Tables 6 and 7).

TABLE 6 NET PRESENT VALUES AND INTERNAL RATES OF RETURN OVER TWENTY YEARS FOR HYBRID COCONUTS

Net Present Value at 15%	$/acre
Commercial	-154
Government financial	- 28
Social	383
Internal Rate of Return	
Commercial	13%
Government financial	15%
Social	20%

TABLE 7 HYBRID COCONUTS. ESTATE OPERATION. COSTS AND RETURNS PER GROSS ACRE ($).

Year	Costs	Returns	Cash Flow
1	522		-522
2	129		-129
3	135		-135
4	144		-144
5	202	41	-161
6	203	244	41
7	303	469	166
8	261	550	289
9	261	548	287
10	261	545	284
11	261	543	282
12	261	540	279
13	261	538	277
14	261	536	275
15	261	534	273
16	261	533	272
17	261	530	269
18	261	528	267
19	261	525	264
20	261	525	264

The rate of return on hybrid coconuts as a commercial enterprise is 13 percent. The real value to the economy at present would be 20 percent. Unfortunately however, stocks of planting material do not exist at present in West Malaysia and hybridisation programme will be required to produce satisfactory seed nuts. Because hybrid material does not exist at present any estimates of future yields must be highly speculative. If yields were to be 10 percent below the projected levels,

the effect on net present value and rate of return on a commercial basis would be:-

	Projected yield	10% lower yield
Net Present Value at 15%	$ -154	$ -276/acre
Internal Rate of Return	13%	11%

The net effect of a 10 percent lower yield allowing for lower processing and labour costs, is to reduce the rate of return by two percent. Similarly a rise of 10 percent would raise returns by two percent.

Because of the heavy discounting factors involved, considering an enterprise life of 30 rather than 20 years has a very minor effect on profitability. The net present value per acre at 15 percent is raised by $80 and the rate of return is increased by just over one percent to about 14.5 percent.

Thus hybrid coconuts as an estate monocrop would appear to yield a similar order of return to oil palms and rubber. But much more uncertainly surrounds the enterprise, though this could to some extent be offset in the long run by better proppects for intercropping.

3.2 Smallholder Production

Some evaluation have been made to assess the profitability of coconuts as a smallholder crop, both as a monocrop and as part of a mixed farming system.

3.2.1 Coconut Monoculture

Coconuts are a traditional smallholder crop in coastal areas of Malaysia. Estate labour estimates suggest that one man can maintain and harvest 20 acres of palms. Such an acreage should therefore be well within the capacity of a smallholder family if it is assumed that whole fruits are sold i.e. the individual producers do not attempt to make copra. This could be done at a central point in a development scheme.

Individual cost items are summarised briefly in Appendix C. Most are similar to those for estate production. During the immature period labour requirements are relatively low, 6-10 man-days per acre, and it is assumed that the producer can obtain employment in the vicinity to offset some of his costs during this period. Labour costs of $500 i.e. about 120 man-days of casual labour, have been charged to the coconut enterprise. In fact much of this labour might be contributed by other members of the smallholder's family.

Two yield assumptions have been made, the first that smallholders attain yield levels equal to those under estate production. The second

that the yield level attained is 10 percent lower than this. It is felt that the latter, especially on inland soils, is the most likely outcome.

The price level assumed is 18 cents per pound of copra equivalent. Although it is assumed that nuts are sold yields have been expressed in terms of copra and the price has therefore been taken to fit this. Table 8 shows net present values at a 15 percent discount rate and internal rates of return for both yield levels. The costs, returns (at the lower yield level), and cash flow are shown in Table 9.

TABLE 8 NET PRESENT VALUES AND INTERNAL RATES OF RETURN, TWENTY ACRE SMALLHOLDING, BY YIELD LEVEL

	High $/acre	Low $/acre
Net Present Value at 15%		
Commercial	-480	-570
Government financial	-370	-460
Social	- 40	-130
Internal Rate of Return (percent)		
Commercial	8	6
Government financial	10	8
Social	14	13

TABLE 9 COCONUT - SMALLHOLDER MONOCULTURE, 20 ACRE SMALLHOLDING. COSTS, RETURNS AND CASH FLOW OVER 20 YEARS.

Year	Costs ($)	Sales (Low yield Level) ($)	Cash Flow ($)
1	11,038	-	-11,038
2	1,678	-	- 1,678
3	1,952	-	- 1,952
4	2,094	-	- 2,094
5	1,894	-	- 1,894
6	1,794	-	- 1,794
7	1,894	648	- 1,246
8	2,794	2,592	- 202
9	2,794	3,888	1,094
10	2,794	4,860	2,066
11	2,794	5,832	3,038
12	2,794	7,128	4,334
13	2,794	7,128	4,334
14	2,794	7,128	4,334
15	2,794	7,128	4,334
16	2,794	7,128	4,334
17	2,794	7,128	4,334
18	2,794	7,128	4,334

TABLE 9 (Contd.)

Year	Costs ($)	Sales (Low yield level) ($)	Cash flow ($)
19	2,794	7,128	4,334
20	2,794	7,128	4,334

The rate of rentumn to the smallholder, after charging his labour, would be six to eight percent, depending upon yield. Such a smallholder would have to support himself, or be supported, at least until year nine. Assuming that he is provided with loans for living expenses during the immature periods indicated in the cost assumptions the total loan outstanding at the end of the year 10 (assuming interest at 7 percent) is $33,000. This could be paid off at $3,116 per year over the next 20 years.

3.2.2 Coconuts with beef cattle

It is not uncommon for cattle to be grazed on grass established under coconuts. Production of beef from such pastures requires very little labour, and a smallholder with 20 acres of coconuts should be able to handle with the help of his family the number of stock that such a holding could be expected to carry.

The combination of beef and coconut production has met with varying success. The yield of the palms may often be reduced by moisture stress caused by the competition from the grass cover for soil moisture. However South Johor has a plentiful and well distributed rainfall and conditions are more likely to favour the success of the combination there than in other parts of West Malaysia. For purposes of this evaluation it has been assumed that the yield of coconuts will remain at the lower of the two levels taken for the monoculture enterprise.

Yields of grass are closely correlated with light intensity. Under the shade cast by a stand of, say, 70 mature coconut palms per acre the yield will probably be not more than half that from open pasture. It has been assumed that the 20-acre holding could support 12 breedings cows and the female followers for replacement, provided that the remainder of the stock were sold at 14-15 months old for fattening elsewhere.

Cross-bred Friesian XLID stock, culled from the new local dairy industry, will become available in increasing numbers and are assumed to form the foundation stock. These cows, mated to a tropical beef type bull, should produce calves of about 600 lb. liveweight at 14-15 months old.

Details of the costs and returns assumed in evaluating the beef enterprise are given in Appendix C. Table 10 shows the cash flows of the

beef and coconut enterprises, separately and the cash flow of the combination. In Table 11 the internal rates of return and net present values per acre for coconuts with and without cattle are shown.

TABLE 10 COCONUTS WITH BEEF CATTLE - 20 ACRE ENTERPRISE CASH FLOWS ($)

Year	Coconuts	Cash Flows (1) Cattle	Total
1	- 11,038	-	-11,038
2	- 1,678	-	- 1,678
3	- 1,952	-	- 1,952
4	- 2,094	-	- 2,094
5	- 1,894	-	- 1,894
6	- 1,794	-	- 1,794
7	- 1,246	- 9,665	-10,911
8	- 202	- 845	- 1,047
9	1,094	1,905	2,999
10	2,066	3,255	5,321
11	3,038	3,255	6,293
12	4,334	3,255	7,589
13	4,334	3,255	7,589
14	4,334	3,255	7,589
15	4,334	3,255	7,589
16	4,334	3,255	7,589
17	4,334	3,255	7,589
18	4,334	3,255	7,589
19	4,334	3,255	7,589
20	4,334	3,255	7,589

TABLE 11 NET PRESENT VALUES PER ACRE AND RATES OF RETURN FOR COCONUTS WITH AND WITHOUT CATTLE.

Internal Rate of Return (Percent)	With Cattle	Without Cattle
Private financial	9	6
Government financial	11	8
Social	15	13
Net Present Value at 15%	$/acre	$/acre
Private financial	-472	-570
Government financial	-362	-460
Social	- 32	-130

Thus the addition of the beef cattle enterprise considerably increases the total profitability. However there are certain problems attached to using such a combination as a basis for a smallholder settlement scheme. A major one is the amount of capital required per unit. The total negative cash flow alone is $32,400 and when interest is assumed on this at seven percent the total sum outstanding per settler in year 9 would be $42,795. This amount could be paid off over 20 years at $4000 per year, or $335 per month. While the expected income flow should be adequate to carry such a burden of debt repayment, land settlement agencies may be reluctant to extend such large loans to individual settlers. The expected cash income of an individual landholder in such a scheme would be as follows:-

Year 1	$1,200
Year 2-6	$ 500
Year 7	$ 600
Year 8-9	$1,500
Year 10	$2,820
Year 11	$3,790
Year 12-29	$5,090
Year 30 on	$9,000

Thus after year 12 the settler might expect to obtain a cash income of about $400 per month.

One possible variation which might help overcome the problems of loan size and lack of expertise with cattle, might be to allow a separate operator to rent the land beneath the palms for cattle. He could provide fencing and stock and be responsible for fertilising the grass. Such an operator could probably handle at least 50 head, or 80 acres or more. Rents might be $20 - $40 per acre or $400 - $800 per year per coconut farmer, which would be a useful income supplement.

3.2.3 Coconuts with Pineapples

During the immature period of the main coconut crops, other crops, eg. tapioca, vegetables, bananas and pineapples can be grown between the coconut palms. The last crop is perhaps the most certain of these in current Malaysia conditions since it can be sold to the Johor canneries at a guaranteed (factory gate) price. The pineapple crop requires some 30 - 40 man-days of labour per year. Assuming that 60 percent of the gross area under coconuts can bbe planted, a 20 acre holding would require 350 to 500 man-days of labour per year, in addition to 120 man-days for the maintenance of the coconuts during the immature period. This is likely to be beyond the capacity of a settler family, leaving aside the problem of the size of the loan involved. Therefore a 10 acre holding has been

assumed in the analysis. Details of costs and returns to a pineapple enterprises extending to a total of 6 acres (60 percent of the 10 acres under coconuts) are given in Appendix C. It is assumed that pineapples are planted in year 2, i.e. the year after planting coconuts.

The cash flows derived from the coconut and pineapple enterprises are shown in Table 12. A charge has been made for the smallholder's labour and included in total costs. The capital sum outstanding at the end of year 8, assuming interest at 7 percent, is $17,600 and this could be paid off over 20 years at $1,750 per annum starting in year 10. Table 13 shows the labour charges and return to management for the settler on a 10 acre holding.

TABLE 12 CASH FLOWS FROM COCONUTS AND PINEAPPLE INTERCROP - 10 ACRES ($)

Year	Coconut	Pineapple	Total
1	-6,619	- 500	-7,119
2	- 839	-2,318	-3,157
3	- 976	1,902	926
4	-1,047	758	- 289
5	- 947	422	- 525
6	- 897	86	- 811
7	- 623		- 623
8	- 101		- 101
9	.547		.547
10	1,033		1,033
11	1,519		1,519
12	2,167		2,167
13	2,167		2,167
14	2,167		2,167
15	2,167		2,167
16	2,167		2,167
17	2,167		2,167
18	2,167		2,167
19	2,167		2,167
20	2,167		2,167

TABLE 13 LABOUR CHARGE, LOAN REPAYMENT AND RETURN TO MANAGEMENT FOR 10-ACRE SMALLHOLDER

Year	Labour charge	Surplus after loan repayment	Total cash income	Loan Repayment
1	1,200	-	1,200	-
2-6	1,250	-	1,250	-
7	300	-	300	-
8	750	-	750	-
9	750	-	750	547
10	750	-	750	1,033
11-30	750	367	1,117	1,750
31 on	750	2,117	2,867	-

It should be pointed out that once the pineapples have been removed the holding would not provide full-time work, especially since it has been assumed that nuts are sold fresh. Some additional labour could be used in making copra. Otherwise the operator would have to engage in some other activity. Table 14 compares returns on a 10 acre coconut holding with and without pineapples.

TABLE 14 NET PRESENT VALUE PER ACRE AND INTERNAL RATE OF RETURN, 10 ACRE HOLDING WITH AND WITHOUT PINEAPPLES

	Without pineapples $/acre	With pineapples $/acre
Net Present value at 15%		
Commercial	-672	-701
Government financial	-562	-591
Social	-232	- 38
Internal Rate of Return		
Commercial	5%	5%
Government financial	7%	7%
Social	12%	15%

Thus in commercial terms the pineapple intercrop is at best a marginal enterprise. If the operator can obtain outside work during the immature period providing him with $1,000 per annum, then it is probably not worth the risk. On the other hand if such employment is not likely tobe available, then the enterprise is probably justified.

3.2.4 Coconuts with cocoa

On the 10 acre holding just described, once the coconut crop is mature and the pineapples removed the holding is not large enough to provide full-time employment for the operator. The mature coconut crop provides considerable shade which inhibits the growth of many potential crops. Some grasses are suitable for such an environment and could be used for a cattle enterprise as discussed in Section 1. A crop which requires shade and can be grown under coconut is cocoa. Because of its need for shade cocoa cannot be interplanted until the main coconut crop is of sufficient height. This is normally attained at 6-8 years of age. As a result a cocoa enterprise could fit fairly well with pineapples or some other less shade tolerant crop the cocoa being planted after the former is removed. In analysis cocoa has been assumed to follow a pineapple crop and be planted in Year 7. Details of the costs and return of a cocoa enterprises are given in Appendix C. Two evaluations have been made, one based on a good and the other on an average yield.

Tables 15 and 16 show the cash flows derived from coconut, pineapple and cocoa enterprises, using the two assumptions. The rates of return are summarised in Table 17.

TABLE 15 CASH FLOWS FROM COCONUTS, PINEAPPLES AND COCOA ON A 10 ACRE HOLDING - ASSUMING HIGH COCOA YIELDS ($).

Year	Coconuts	Pineapples	Cocoa	Total
1	-6,619	- 500		-7,119
2	- 839	-2,318		-3,157
3	- 976	1,902		926
4	-1,047	758		- 289
5	- 947	422		- 525
6	- 897	86		- 811
7	- 623		-2,095	-2,718
8	- 101		-1,225	-1,326
9	547		- 981	- 434
10	1,033		85	1,118
11	1,519		1,477	2,996
12	2,167		2,125	4,292
13	2,167		2,065	4,232
14	2,167		2,005	4,172
15	2,167		1,945	4,112
16	2,167		1,945	4,112
17	2,167		1,945	4,112
18	2,167		1,945	4,112
19	2,167		1,945	4,112
20	2,167		1,945	4,112

TABLE 16 CASH FLOWSSFROM COCONUTS, PINEAPPLES AND COCOA ON A 10 ACRE HOLDING - ASSUMING LOW COCOA YIELD ($).

Year	Cocoonuts	Pineapple	Cocoa	Total
1	-6,619	- 500		-7,119
2	- 839	-2,318		-3,157
3	- 976	-1,902		926
4	-1,047	758		- 289
5	- 947	422		- 525
6	- 897	86		- 811
7	- 623		-2,095	-2,718
8	- 101		-1,225	-1,326
9	547		-1,725	-1,177
10	1,033		- 635	398
11	1,519		61	1,580
12	2,167		733	2,900
13	2,167		1,381	3,548
14	2,167		1,333	3,500
15	2,167		1,285	3,452
16	2,167		1,285	3,452
17	2,167		1,285	3,452
18	2,167		1,285	3,452
19	2,167		1,285	3,452
20	2,167		1,285	3,452

TABLE 17 INTERNAL RATES OF RETURN AND NET PRESENT VALUE PER ACRE FOR 10-ACRE HOLDING WITH COCONUTS ONLY AND WITH PINEAPPLE AND COCOA INTERCROPS.

	Coconuts only	With Cocoa and pineapples	
		High cocoa yield	Low cocoa yield
Internal Rate of Return			
Private financial	5%	9%	6%
Government financial	7%	11%	8%
Social	12%	18%	15%
Net Present Value at 15%	$/acre	$/acre	$/acre
Private financial	-672	-589	-763
Government financial	-562	-479	-653
Social	-232	215	41

The overall profitability of the coconut holding has been improved by the addition of the cocoa enterprise. However if cocoa yields are at the lower level assumed, this improvement is only marginal. Since the combined coconut cocoa holding requires at least one man to operate it (some family help would probably be required), a labour change of $1500 per annum has been made from year 7 onwards. The total debt in year 10 depends upon how quickly the cocoa comes into production, but is $23,450 for the high yield assumption and $25,000 for low yields. These could be paid off in 20 annual instalments of $2,200 or $2,350 respectively. Total cash incomes would then be as shown in Table 18.

TABLE 18 SETTLER CASH INCOMES ON COCONUT/COCOA HOLDINGS AT HIGH AND LOW COCOA YIELDS.

Year	Labour charge	Low cocoa yield		High cocoa yield	
		Surplus after loan repayment	Total cash income	Surplus after loan repayment	Total cash income
1	1,200	-	1,200	-	1,200
2-6	1,250	-	1,250	-	1,250
7	1,050	-	1,050	-	1,050
8-10	1,500	-	1,500	-	1,500
11	1,500	-	1,500	796	2,296
12	1,500	550	2,050	2,092	3,592
13	1,500	1,200	2,700	2,032	3,532
14	1,500	1,150	2,650	1,972	3,472
15-30	1,500	1,100	2,600	1,912	3,412
31 +	1,500	3,450	4,950	4,110	5,610

This emphasises the nature of the problem associated with a development of this type. The settler has to live on an income of about $100 per month for about 10 years until his cocoa crop is mature. If the cocoa yields well then he may get a cash income of about $300 per month during the period of loan repayment. If yields are low however this income is likely to be severely cut back, to $200 or so. Since much research work still has to be done on cocoa and likely yield levels are not known with any accuracy, a considerable risk attaches to such a development pattern. It is questionable whether a settler should be exposed entirely to such risk. If coconuts are planted in the next few years it will not be until 1980 or later when cocoa can be interplanted. By that time the necessary development work on the crop should have been completed and enough known to determine whether the crop will be viable in Malaysia. However, the Government should be willing to accept the risk involved and indemnify settlers in some way if it proves inadvisable to plant cocoa.

4. SUMMARY AND RECOMMENDATIONS.

The commercial, financial and social rates of return of the various enterprises evaluated in section 3 are compared in Table 19.

TABLE 19 RATES OF RETURN OF EVALUATED ENTERPRISES (%).

Enterprise	Internal Rate of Return		
	Commercial	Financial	Social
Estate production-seedling nuts	1-3	3	9
Estate production-hybrid palms	13	15	20
Smallholder production-monoculture	6	8	13
Smallholder production-coconuts + beef	9	11	15
Smallholder production-coconuts + pineapples	5	7	15
Smallholder production-coconuts + pineapples + cocoa	6-9	8-11	15-18

It is clear that estate production of coconuts, using available selected seedling nuts, is not commercially attractive. For smallholders, even if the production is combined with either a beef or high yielding cocoa enterprise, the holding is not likely to be as profitable as a rubber or oil palm one. Seedling coconut production is not therefore recommended as a large scale diversification enterprise in the Project Area. Coconuts with beef could be useful in small and isolated river valleys, where periodic flooding could make rubber marginal, and where processing facilities for oil palms could not be made available economically. However the shortage of agronomic data on which to base advice to a farmer about to embark on a coconut cum beef enterprise, coupled with a lack of suitable stock, and the negligible knowledge of cattle husbandry among most smallholders, would add greatly to the uncertainties surrounding the enterprise, and make an early start virtually unthinkable. Neither, in view of the relatively small areas of land involved, can any priority be recommended for an experimental programme to solve the problems.

Production based on the use of hybrid coconuts on the other hand promises to be most rewarding, and it is recommended that high priority be given at the MARDI research station to a comprehensive agronomic programme and to the establishment of limited multiplication facilities. The first point to ascertain is the performance of any of the available hybrid material on the inland soils of the Project Area. The Director of the Ivory Coast Coconut Research Institute has indicated both verbally and in correspondence with the Consultants his readiness to supply a few hundred nuts, which could be used for trial plantings.

It is strongly recommended that this offer be accepted and that the Director be asked to send for trial those hybrids he considers likely to be best suited to the Rengam and Harimau soil services, which should be fully described in the request.

This initial supply of nuts should be divided up to allow trials on the three soil services. Each trial should be planted at the density recommended by the Director and should be maintained at a good standard of commercial management. Yield performance data should become available from 4-5 years after planting.

If the hybrids perform as well as is hoped, facilities for multiplication of commercial quantities of hybrid nuts will be required. A modest expenditure to establish at once small units of breeding material in anticipation of a good performance, would be a risk worth taking. Suitable female palms are available in West Malaysia, but existing Malayan Tall palms are a highly heterozygons population, and will remain unsuitable for breeding until after many years of selection. It is therefore recommended that a small quantity of West African Tall nuts be planted in an isolated nursery as soon as possible.

If it is possible to find existing isolated areas of yellow dwarf nuts growing on the appropriate inland soils series the hybridisation programme could be speeded up by importing immdeiately West African Tall pollen from the Ivory Coast.

The possibility of breeding a suitable Malayan tall palm for crossing would be worth investigation. The most likely source of repeatedly in bred material would be an off-shore island e.g. Natuna, where the original seed probably came from a few palms.

APPENDIX A

MARKET PROSPECTS

1. INTRODUCTION

The coconut palm is perhaps the most versatile of all economic plants, yielding a wide variety of products of dietary, general domestic and industrial use. Its present commercial importance, however, is largely confined to coconut oil, which is expelled from copra, the dried kernel of the mature nut.

Coconut oil is used in the manufacture of margarine, cooking oils and shortening, and industrially in the production of soap, fatty alcohols, plasticizer, degradable detergents and explosives. Its importance, relative to other oils, lies in its chemical composition. The high saponification value of 250-260 and the very low iodine number (8-10) result from the fatty acid components, of which about 91 percent are saturated and 45 to 50 percent is lauric acid. This latter factor confers good lathering properties in soap, shampoos and shaving cream, making it extremely useful in the soap and cosmetic industries. This richness in lauric and other fatty acids of low molecular weight is also important in the manufacture of fatty alcohols.

2. LOCAL MARKET

The study of production and consumption of coconuts and coconut products in W. Malaysia is complicated by a number of factors:-

(a) The bulk of commercial production is by smallholders and information on them may be subject to a fair degree of error.

(b) A great number of coconuts are produced for home consumption in towns and kampongs. It is impossible to estimate domestic production. It will be assumed that fresh coconuts are home produced and demand for this use will not be considered. However it should not be forgotten that as urban growth continues and gardens become smaller town dwellers will buy a greater proportion of the nuts they require for confectionery use. Market demand for fresh nuts will therefore grow steadily.

(c) Coconut oil and palm kernel oil have very similar properties. Coconut oil has been widely used for a long time for cooking purposes. It is known that it is common practice for oil millers in Malaysia to mix these two products for sale as cooking oil. The extent to which this is done is not known. Figures on palm kernel oil production are not at present available and it is not known whether figures for coconut oil production contain some element of palm kernel oil. It will be as-

sumed here that figures for coconut oil do not include palm kernel oil.

An attempt will therefore be made to estimate consumption of coconut and palm kernel oil combined for domestic purposes and this will be projected forward for the study period.

The production of coconut oil by local mills and trade has been reported by the Statistics Department for the period 1963-1968 as in Table 1.

TABLE 1 PRODUCTION AND TRADE IN COCONUT OIL (TONS)

Year	Copra Purchased by mills	Oil Expressed	Imports	Exports	Available supply
1963	128,671	71,281	1998	29,738	43,541
1964	108,189	62,132	1565	14,517	49,180
1965	108,947	63,767	1356	18,050	47,073
1966	136,763	83,418	2618	25,068	60,968
1967	139,085	85,643	862	29,030	57,475
1968	151,745	89,954	1429	38,399	52,984

As noted above production figures are not available for palm-kernel oil. The estimates in Table 2 are obtained from apparent domestic disappearance of palm kernels assuming that on crushing the kernels yield 45 percent oil. The figures for exports in the table include increases in domestic stocks.

TABLE 2 ESTIMATED PALM KERNEL OIL PRODUCTION 1963-1968 (TONS).

Year	Production of kernels	Export	Domestic use	Oil expressed
1963	32,054	19,474	12,580	5,661
1964	30,001	17,442	12,559	5,652
1965	34,426	19,209	15,217	6,848
1966	42,669	22,775	19,894	8,952
1967	48,318	23,266	25,052	11,273
1968	58,715	31,963	26,752	12,038

The total availability of these two oils will then have been as follows:-

1963	49,202 (tons)
1964	54,832
1965	53,921
1966	69,920
1967	68,748
1968	65,022

These oils are also used for soap manufacture, together with tallow. The UN. Industrial Profiles indicated that one ton of oil or tallow produces approx 2½ tons of soap. Using this figure and import values for tallow the quantity of domestic oil used for soap manufacture has been estimated in Table 3 and the available supply for other domestic purposes is shown in Table 4.

TABLE 3 USE OF COCONUT AND PALM KERNEL OIL FOR SOAP MANUFACTURE (TONS)

Year	Soap Manufacture	Oil and Tallow requirement.	Tallow imported	Oil requirements
1966	33,300	13,320	5,618	7,702
1967	29,400	11,760	8,874	2,886
1968	34,100	13,640	8,216	5,424

TABLE 4 AVAILABILITY OF COCONUT AND PALM KERNEL OIL FOR OTHER DOMESTIC USE (TONS)

Year	Total supply	Use of soaps	Available supply for other domestic uses
1966	69,920	7,702	62,218
1967	68,748	2,886	65,862
1968	65,022	5,424	59,598

The average available supply of coconut and palm kernel oils in the period 1966-1968 was thus 62,559. This is equal to a per capita consumption of 0.007 tons per year. Future demand for these oils for domestic purposes is estimated in Table 5 (assuming an income elasticity of demand of 0.6, population growth of 3 percent and per capita income growth of 2.5 percent per annum). Also in Table 5 demand for oils for

soap manufacture has been projected at a 4 percent per annum rate of growth. Total demand for coconut and palm kernel oils is thus projected to rise from almost 78,000 tons in 1970 to 193,000 tons in 1990.

TABLE 5 DEMAND FOR COCONUT AND PALM KERNEL OIL (TONS)

Year	Cooking per capita	Total cooking demand	Soaps	Total
1970	0.007445	71,765	6,003	77,768
1975	0.008051	89,619	7,304	96,923
1980	0.008735	112,714	8,887	121,601
1985	0.009509	142,245	10,817	153,062
1990	0.010385	180,097	13,154	193,251

The F.A.O. Economic Survey of the Coconut Industry of 1968 indicated that copra production in W. Malaysia had remained virtually static over the past 20 years. Since no major replanting effort is at present underway the situation will not change significantly over the next ten years, and it will be assumed that copra production per annum is 150,000 tons until 1990. Table 6 then shows the qunatity of palm kernel oil required to meet the demand estimated in Table 5. This required quantity can be seen to increase rapidly to 100,000 tons by 1990.

TABLE 6 COPRA AND COCONUT OIL PRODUCTION AND PALM KERNEL OIL REQUIREMENT (TONS)

Year	Copra production	Coconut oil expressed	Minimum palm kernel oil required.
1970	150,000	90,000	12,232
1975	150,000	90,000	6,923
1980	150,000	90,000	31,601
1985	150,000	90,000	63,062
1990	150,000	90,000	103,251

Table 7 shows the expected supply of palm kernels and kernel oil, based on an assumed future planting rate of 50,000 acres per year of oil palm.

TABLE 7 PROJECTED PALM OIL, KERNEL AND KERNEL OIL OUTPUTS (THOUSAND TONS)

Year	Palm oil	Palm kernels	Kernel oil
1970	400	91	41
1975	800	182	82
1980	1,275	290	130
1985	1,750	398	179
1990	2,200	500	225

Notes (1) Palm kernels assumed as 22.73 percent of oil output.

(2) Palm kernels assumed to yield 45 percent oil.

Available supplies of coconut and palm kernel oil are therefore likely to be more than adequate to meet Malaysian demand in the next 20 years. Quantities of both palm kernels and copra (or oil) are likely to be available for export throughout.

3. WORLD MARKET

The international fats and oils market is extremely complex, being made up of over 20 different products produced and consumed in all parts of the world. Table 8 shows the production and export of the major categories of fats and oils in this market during the period 1960 to 1970. During this decade total output of fats and oils has increased by about 10 million tons from just over 30 million tons per year, or about 2.7 percent per year. Trade has increased from 9 to 13 million tons per year or at a compound rate of some 4 percent per annum. These increases have however not been spread evenly across the oils and fats market as a whole. The bulk of the increase has come from edible vegetable oils, especially soybean, sunflower and rapeseed oils. Production of tropical palm oils, (palm oil, palm kernel oil and coconut oil), has remained static and fallen from 12 to 10 percent of all fats and oils. Trade in these oils has declined slowly from 25 percent to under 20 percent by the end of the decade. Coconut oil exports have fallen from 14 percent to 10 percent of the total, the major part of this fall coming in the second half of the decade.

This lack of growth of copra output is due to a number of factors:-

1. Estate copra production has fallen because:

(a) Many plantations deteriorated or were destroyed during the hostilities or as a result of subsequent political changes;

(b) Estate palms are reaching the end of their useful life and are being replaced by oil palms which, having benefited from considerable research, give a bigger return per acre.

Smallholder production has not expanded first because increased domestic consumption of fresh nuts has limited copra production and, secondly, many village groves are comprised of old palms whose production is declining. Replanting however means foregoing the income which they would give in the period before new palms start to bear.

Efforts have been made, particularly in the Phillipines which is the major producer, to encourage replanting. However output in that country has been severely hit by a number of typhoons and this is a major reason for the fall in output and exports since 1965.

Given the relatively long gestation period of about 8 years for coconuts, world production cannot be expected to expand significantly in the next decade. Since population is growing steadily in most producing countries, demand for coconut oil and nuts for local consumption will continue to increase as in Malaysia, and quantities entering world trade will probably continue to decline slightly.

Table 9 shows the average price of exports of palm kernels and coconut oil from W, Malaysia since 1963.

TABLE 9 AVERAGE PRICE OF EXPORTS OF PALM KERNELS AND CRUDE COCONUT OIL (M$ PER TON)

Year	Palm kernels	Crude coconut oil
1963	376	737
1964	393	823
1965	462	907
1966	403	788
1967	375	788
1968	443	984

The general level has remained fairly steady despite year to year fluctuations. The sharp increase in 1968 resulted from reduced supplies from the Philippines because of crop damage. Prices of other fats and oils, particularly palm oil, tended to fall in that year because of increased supplies. This difference results from the relatively specific nature of the demand for coconut and palm kernel oils. For the fats and oils market as a whole there appears to be a prospect of supply (particularly of edible vegetable oils) expanding slightly more rapidly than effective demand with a consequent down

trend in prices. Because of the specificity of demand for cooonut and palm kernel oils these products should resist the trend more successfully than most.

Palm kernel supplies have principally come from Nigeria and Congo (Kinshasa), where the palms are mainly of the Dura type with a high kernel content. Tenera and Pisifer types grown in Malaysia and Indonesia have lower kernel contents. These latter types give much higher palm oil yields and expansion is largely of these types. Since the kernel oil/palm oil proportion is about 1:10 a doubling of kernel oil supplies to about 750,000 tons would mean increasing palm oil output by four times to 5 million tons. It is therefore highly unlikely that expansion of palm oil and kernel output will result in kernel oil flooding the coconut/palm kernel oil market especially since coconut oil output is likely to continue to grow so slowly. Projected prices for palm kernels, copra and coconut oil are shown in Table 10.

TABLE 10 PROJECTED PRICE OF PALM KERNELS AND CRUDE COCONUT OIL (M$/TON).

Year	Palm kernel	Copra	Coconut oil
1975	370	450	820
1980	360	440	800
1985	350	430	782
1990	340	422	765

	1960-64 average		1966		1967		1968 (Preliminary)		1970 (ind. est.)	
	Million short tons	Per cent	Million short tons	Per cent	Million short tons	Per cent	Million short tons	Per cent	Million short tons	Per cent
Production										
Palm oils:										
Palm kernel	.46	1.3	.44	1.1	.38	1.0	.39	1.0		
Palm	1.32	3.9	1.38	3.6	1.24	3.2	1.40	3.5		
Coconut	2.42	7.0	2.58	6.7	2.34	5.9	2.22	5.5		
Total	4.20	12.2	4.40	11.4	3.96	10.1	4.01	10.0		
Edible vegetable oils	15.14	44.1	18.02	46.5	18.68	47.7	19.62	48.9	n.a	
Industrial oils	1.59	4.6	1.80	4.6	1.60	4.1	1.41	3.5		
Animal fats	12.28	35.7	13.22	34.2	13.61	34.7	13.82	34.4		
Marine oils	1.18	3.4	1.26	3.3	1.35	3.4	1.30	3.2		
Total	34.39	100.0	38.70	100.0	39.20	100.0	40.16	100.0		
Exports										
Palm oils:										
Palm kernel	.41	4.1	.41	3.6	.30	2.6	.32	2.7	0.37	2.8
Palm	.61	6.1	.68	6.0	.55	4.7	.60	5.0	0.85	6.4
Coconut	1.42	14.3	1.53	13.6	1.30	11.1	1.19	9.9	1.25	9.4
Total	2.44	24.5	2.62	23.2	2.15	18.4	2.11	17.6	2.48	18.7
Edible vegetable oils	3.63	36.5	4.78	42.5	5.25	44.9	5.53	46.1	6.69	50.4
Industrial oils	.74	7.4	.74	6.6	.73	6.2	.66	5.5	0.79	6.0
Animal fats	2.31	23.2	2.37	21.1	2.65	22.6	2.75	22.9	2.46	18.6
Marine oils	.84	8.4	.74	6.6	.92	7.9	.95	7.9	0.84	6.3
Total	9.96	100.0	11.25	100.0	11.70	100.0	12.00	100.0	13.26	100.0

Compiled from data in Foreign Agricultural Circulars October 1968
October 1970

APPENDIX B

COCONUTS-ESTATE PRODUCTION

1. USING SELECTED SEEDLING PALMS

1.1 Production Costs.

Production costs are summarised in Table 1. Basic assumptions are given below:-

1.1.1 Clearance

$150 per gross acre.

1.1.2 Planting

Expenditure in year 1 is as follows:-

		$
65 palms per acre @ $1.50 each	-	97.50
Cover crop	-	5.00
Labour 10 man-days per acre	-	47.50
		150.00

1.1.3 Roads

Year 1 - $15 per planted acre. This is assumed to consist of 1 chain of laterite road (at a cost of $45 per chain) per 3 acres of crop.

Years 2-6 maintenanance at $5 per acre.

Year 7 additional laterite roads at 1 chain per 6 acres plus harvesting paths and maintenance - assumed cost $15 per acre.

Year 8 onward - $5 per acre maintenance.

1.1.4 Fertiliser

It is assumed that a compound fertiliser is used and an average cost of $270 per metric ton has been taken. Requirements are:-

Year 1 and 2	180 lb. per acre	-	$24
Year 3	240 lb. per acre	-	$29
Year 4	300 lb. per acre	-	$36
Year 5 onwards	360 lb. per acre	-	$43

In addition 100 lb of crushed limestone is assumed applied per acre at a cost of $2.

1.1.5 Chemicals

A charge of $25 per crop acre has been assumed to cover herbicides and pesticides in the years 1-5 and $17.50 thereafter as the crop begins to shade out weed competition.

1.1.6 Machinery

It is assumed that the crop on an estate would be collected by tractor and trailer and brought to the central factory area for drying. Assuming dehusking is carried out in the field the weight of nuts to be taken to the factory would be about 5 tons per acre for a 2,000 lb per acre copra yield. One tractor and trailer should be able to collect about four loads per day and cope with 800 to 1,000 acres. The cost of a 40 h.p. tractor plus trailer would be approximately $14,000.

In addition transportation, e.g. Land Rover, would be required for management.

Costs have been taken as follows:-

Year	Cost
1	$5 per crop acre
2-6	$3 per crop acre
7	$20 per crop acre
8 onwards	$6 per crop acre

1.1.7 Management

Assumed to be $20 per crop acre throughout. This is approximately two-thirds the expenditure on rubber estates. Since field labour numbers are approximately one-half those for rubber, supervisory staff in the sub-manager level would be similarly reduced in numbers.

1.1.8 Labour

Labour has been costed at a constant $132 per man month ($1,584 per man year). Labour requirements are as follows:-

	Years	Field	Factory	Total
		man years/acre		
9m-d/rai	2 - 7	0.03	-	0.03
15m-d/rai	8 onwards	0.05	0.015	0.065

Costs per crop acre are therefore:-

Year	Cost
2 - 7	48
8 onwards	103

1.1.9 Housing

General housing costs are based upon standard F.L.D.A. estimates of $1,600 per unit, $1,500 for the dwelling structure and $100 for site preparation. It is assumed that 2 houses are constructed per 100 acres in year 1 and a further 2 in year 7. This assumes an average of 1.5 workers per household.

In addition management housing and other buildings (i,e. office, garage) are assumed to cost $30 per crop acre in year 1.

Total housing costs are then as follows:-

Year	Cost per crop acre
1	62
2-6	2
7	35
8 onwards	3

1.1.10 Processing

It is assumed that copra would be dried by means of an oil-fired drier. Assuming an output of 1 ton of copra per acre per annum, drier capacity would have to be approximately 1/3 ton per day per 100 acres of crop. Operating costs of oil-fired driers have been reported as $17 per ton. A copra drying cost of $25 per ton has been taken to include maintenance and depreciation of drier plus sundry operating expenses. An additional $10 per crop acre has been assumed to be required for necessary building and installation.

1.1.11 Transport

Most copra from the project area would probably be sold to local oil mills. A charge of $6 per ton (equivalent to carriage of about 40 miles) has been assumed.

1.1.12 Rents and premium

These charges have been taken as current Johor practice:-

Premium - $50 per gross acre.

Rent - $10 per gross acre for coconut holdings of over 500 acres.

1.1.13 Other costs

$2 per gross acre.

1.2 Yields

Yields and prices have been assumed as indicated in main text. Assuming a planting in 1972 total sales are as follows:-

Year from planting.	Yield per crop acre (tons).	Yield per gross acre (tons)	Price per ton ($)	Sales per gross acre ($).
7	0.09	0.077	442	34
8	0.36	0.303	440	133
9	0.54	0.456	438	200
10	0.67	0.570	436	249
11	0.80	0.683	434	297
12	0.98	0.835	432	361
13	0.98	0.835	430	359
14	0.98	0.835	429	358
15	0.98	0.835	427	357
16	0.98	0.835	426	356
17	0.98	0.835	424	354
18	0.98	0.835	422	352
19	0.98	0.835	420	351
20	0.98	0.835	420	351

2. USING HYBRID PALMS

2.1 Production Costs

Hybrid coconuts were assumed to be produced on the same estate basis as with current selected material. However a number of costs were taken at a higher level to reflect the higher cost of planting material and higher yields. The costs are shown in Table 2.

2.1.1 Planting material

An additional cost of $1 per seedling was assumed, making a total of $2.50. Total cost of planting material is $162.50.

2.1.2 Fertiliser

This has been increased by 50 percent in line with expected peak yield increase. Expenditure per planted acre is:-

Year	Cost per acre
1-2	$36
3	$43
4	$53
5 onwards	$64

2.1.3 Labour

Hybrid are assumed to begin yielding in year 5 and to reach a peak yield of 3,300 lbs copra per acre. To cope with this, labour requirements at maturity have been raised to 0.08 man-years per acre. Total labour requirements have therefore been taken as follows:-

Year	Man-years per crop acre
2-4	0.03
5-6	0.06
7 onwards	0.08

2.1.4 Processing and Transport

These costs are based upon the same cost per ton as before i.e. $25 per ton for copra drying, bagging, etc. and $6 per ton transport to buyer.

2.2 Returns

Yields have been assumed as follows:-

Year from planting	Yield per planted acre (lbs)
5	240
6	1,450
7	2,800
8 onward	3,300

Prices have been assumed as in the main text. Assuming a planting in 1972 total sales are therefore as follows:-

Year from planting	Yield per crop acre (tons)	Yield per gross acre (tons)	Price per ton ($)	Sales per gross acre ($)
5	0.107	0.091	447	41
6	0.647	0.550	444	244
7	1.250	1.062	442	469
8	1.473	1.250	440	550
9	1.473	1.250	438	548
10	1.473	1.250	436	545
11	1.473	1.250	434	543
12	1.473	1.250	432	540
13	1.473	1.250	431	538
14	1.473	1.250	429	536
15	1.473	1.250	427	534
16	1.473	1.250	426	533
17	1.473	1.250	424	530
18	1.473	1.250	422	528
19	1.473	1.250	420	525
20	1.473	1.250	420	525

TABLE 1 COCONUTS - SELECTED SEEDLINGS - ESTATE CULTIVATION - COSTS ($ PER GROSS ACRE)

Year	Clearance, roads and planting	Fertiliser	Machinery	Chemicals	Housing	Labour	Management	Rent and other	Processing	Transport	Total Costs
1	290	20	4	21	53	-	17	52	-	-	457
2	4	20	3	21	2	40	17	12	-	-	119
3	4	24	3	21	2	40	17	12	-	-	123
4	4	30	3	21	2	40	17	12	-	-	129
5	4	36	3	15	2	40	17	12	-	-	129
6	4	36	3	15	2	40	17	12	-	-	129
7	13	36	17	15	30	87	17	12	12	-	239
8	4	36	5	15	3	87	17	12	8	2	189
9	4	36	5	15	3	87	17	12	11	3	193
10	4	36	5	15	3	87	17	12	14	3	196
11	4	36	5	15	3	87	17	12	21	4	204
12	4	36	5	15	3	87	17	12	21	5	205
13	4	36	5	15	3	87	17	12	21	5	205
14	4	36	5	15	3	87	17	12	21	5	205
15	4	36	5	15	3	87	17	12	21	5	205
16	4	36	5	15	3	87	17	12	21	5	205
17	4	36	5	15	3	87	17	12	21	5	205
18	4	36	5	15	3	87	17	12	21	5	205
19	4	36	5	15	3	87	17	12	21	5	205
20	4	36	5	15	3	87	17	12	21	5	205
15%	314.80	216.20	33.45	127.65	79.90	381.68	122.36	126.37	45.73	9.44	1,461.56

Year	Clearance, roads and planting	Fertiliser	Machinery	Chemicals	Housing	Labour	Management	Rent and other	Processing	Transport	Total Costs
1	345	30	4	21	53	-	17	52	-	-	522
2	4	30	3	21	2	40	17	12	-	-	129
3	4	36	3	21	2	40	17	12	-	-	135
4	4	45	3	21	2	40	17	12	-	-	144
5	4	54	3	15	2	80	17	12	15	-	202
6	4	54	3	15	2	80	17	12	13	3	203
7	13	54	17	15	30	112	17	12	27	6	303
8	4	54	5	15	3	112	17	12	31	8	261
9	4	54	5	15	3	112	17	12	31	8	261
10	4	54	5	15	3	112	17	12	31	8	261
11	4	54	5	15	3	112	17	12	31	8	261
12	4	54	5	15	3	112	17	12	31	8	261
13	4	54	5	15	3	112	17	12	31	8	261
14	4	54	5	15	3	112	17	12	31	8	261
15	4	54	5	15	3	112	17	12	31	8	261
16	4	54	5	15	3	112	17	12	31	8	261
17	4	54	5	15	3	112	17	12	31	8	261
18	4	54	5	15	3	112	17	12	31	8	261
19	4	54	5	15	3	112	17	12	31	8	261
20	4	54	5	15	3	112	17	12	31	8	261
15%	369.80	324.31	33.45	127.65	79.90	495.58	122.36	126.37	101.51	23.40	1,808.33

APPENDIX C

COCONUTS - SMALLHOLDER PRODUCTION.

1. MONOCULTURE

1.1 Production Costs

1.1.1 Land clearance $150 per acre. It is assumed that 23 acres are cleared to obtain a cropped area of 20 acres.

1.1.2 Planting material 65 seedlings at $1.50 - $97.50.

Cover crop seed	-	$5/acre
Total	-	$102.50

1.1.3 Fertilisers

Year 1 - 2	-	$22
Year 3	-	$36
Year 4 onwards	-	$43

1.1.4 Chemicals

Years 1 - 4	-	$25 per acre.
Year 5	-	$15 per acre.
Years 6 onwards	-	$10 per acre.

1.1.5 Housing

House cost	-	$1,600
Maintenance	-	$80 per annum.

1.1.6 Premium and rent

Premium	-	$50 per acre.
Rent	-	$7 per acre.

1.1.7 Labour

It was assumed that approximately 120 man-days of casual labour would be required in year 1 to allow planting to be completed in about three months.

The operator's own labour has been charged at the following rates:-

Year 1	$100/month	-	$1,200
Years 2-6	120 man-days	-	$ 500
Year 7	140 man-days	-	$ 600
Year 8 onwards	$125/month	-	$1,500

TABLE 1 COCONUTS - SMALLHOLDER 20 ACRES ($)

Year	Clearance	Planting material	Fertiliser	Chemicals	Equipment	House	Premium and rent	Own labour	Casual	Total cost
1	3,450	2,100	438	500	100	1,600	1,150	1,200	500	11,038
2	-	-	438	500	-	80	160	500	-	1,678
3	-	-	712	500	-	80	160	500	-	1,952
4	-	-	854	500	-	80	160	500	-	2,094
5	-	-	854	300	-	80	160	500	-	1,894
6	-	-	854	200	-	80	160	500	-	1,794
7	-	-	854	200	-	80	160	600	-	1,894
8	-	-	854	200	-	80	160	1,500	-	2,794
9	-	-	854	200	-	80	160	1,500	-	2,794
10	-	-	854	200	-	80	160	1,500	-	2,794
11	-	-	854	200	-	80	160	1,500	-	2,794
12	-	-	854	200	-	80	160	1,500	-	2,794
13	-	-	854	200	-	80	160	1,500	-	2,794
14	-	-	854	200	-	80	160	1,500	-	2,794
15	-	-	854	200	-	80	160	1,500	-	2,794
16	-	-	854	200	-	80	160	1,500	-	2,794
17	-	-	854	200	-	80	160	1,500	-	2,794
18	-	-	854	200	-	80	160	1,500	-	2,794
19	-	-	854	200	-	80	160	1,500	-	2,794
20	-	-	854	200	-	80	160	1,500	-	2,794

These costs over a 20 year period are shown in the accompanying table.

1.2 Returns

It has been assumed that smallholder yields will be ten percent below those obtained by estates. Yields used are as follows:-

Year	Copra yield (lbs/acre)
7	180
8	360
9	540
10	1,350
11	1,620
12	1,980

Because the operator will be fairly fully engaged in maintaining and harvesting the 20 acre holding it has been assumed that nuts are sold, possibly to a central copra drying plant. A price of 18 cents per pound of copra equivalent has been used. This is equivalent to a price of 8-9 cents per nut or $24 per pikul of copra. This leaves a margin of about $2.50 per pikul or $40 per ton to cover drying and transport.

2. COCONUTS WITH BEEF CATTLE

2.1 Production Costs of Beef Enterprise

2.1.1 Pasture establishment

Some cultivation will be necessary before seeding or planting. This will have to be relatively shallow to avoid damaging the coconut's root system. Probably fairly shallow disc ploughing or harrowing would be adequate. This has been costed at $40 per acre.

Seed costs have been taken at $20 per acre.

2.1.2 Fertiliser

It is assumed that a grass-legume mixture will be used. Fertiliser requirements for pastures of this type are not yet firmly established, but are expected under normal conditions to be about 2 cwt super phosphate plus 2 cwt of compound (N.P.K.) fertiliser per annum plus periodic dressings of lime costing about $60 per acre. Owing to the shade cast by the coconut palms effective production is likely to be about half that in normal range conditions. A fertiliser cost of $30 per acre has therefore been used.

2.1.3 Fencing

Approximately one mile of fencing will be required to provide a perimeter fence and divide the holding into two paddocks. This will cost about $600 or $30 per acre. Maintenance is 5 percent per annum.

2.1.4 Stock purchase

Pastures under coconut are expected to have a capacity of about 3/4 or an animal per acre. It is expected that cows will suckle their calves for about 7 months. Calves are then run for a further 7-8 months before sale for fattening elsewhere. On this basis a 20 acre holding should have a total capacity of 12 cows plus offspring.

Normal practice is run one bull with 25 to 30 females. In this type of operation it might be possible for two operator's to share 1 bull. Artificial insemination is also a possibility but is somewhat more difficult to organize. There is at present no market for stud bulls in the country but approximately $2,500 is a likely price. Half of this figure has been charged to the enterprise, and an annual $120 charge has been made for replacement purposes.

It is expected that growth of the diary industry in Johor will result in a steady supply of cull crossbred female stock. In evaluating dairy enterprise these have been valued at $500 per head. This value has been used here. It is assumed that 12 cows are purchased when the enterprise is started. Three have to be sold (at $450) and 3 more are purchased in the second year. After this home-bred heifers are kept for replacing old breeding cows.

2.1.5 Labour

It is assumed that the enterprise can be carried out by the operator with no additional help.

2.2 Sales

It is assumed that 11 calves are produced per year. Of these 3 females are kept for breeding and the remaining 8 sold for fattening at 14 - 15 months, at a weight of 600 lbs.

Annual sales are therefore:-

8 fatteners	@	$340	= 2,720
3 culls	@	$450	= 1,350
			4,070

2.3 Summary

The costs, sales and net cash flow of the beef enterprise are shown in Table 2. The combined cash flow from the joint coconut/beef enterprise is given in Table 3.

3. COCONUTS WITH PINEAPPLES

3.1 Production Costs of Pineapples

The costs associated with a pineapple enterprise have been taken as follows:-

TABLE 2 SUBSIDIARY BEEF CATTLE ENTERPRISE - COSTS, RETURNS AND NET CASH FLOW ($)

Year	Pasture establishment	Fertiliser	Fencing	Vetinary	Stock purchase	Total cost	Sales culls	Sales calves	Total sales	N.C.F.
7	1,200	600	600	65	7,200	9,665	-	-	-	-9,665
8	-	600	30	65	1,500	2,195	1,350	-	1,350	- 845
9	-	600	30	65	120	815	-	2,720	2,720	1,905
10	-	600	30	65	120	815	1,350	2,720	4,070	3,255
11	-	600	30	65	120	815	1,350	2,720	4,070	3,255
12	-	600	30	65	120	815	1,350	2,720	4,070	3,255
13	-	600	30	65	120	815	1,350	2,720	4,070	3,255
14	-	600	30	65	120	815	1,350	2,720	4,070	3,255
15	-	600	30	65	120	815	1,350	2,720	4,070	3,255
16	-	600	30	65	120	815	1,350	2,720	4,070	3,255
17	-	600	30	65	120	815	1,350	2,720	4,070	3,255
18	-	600	30	65	120	815	1,350	2,720	4,070	3,255
19	-	600	30	65	120	815	1,350	2,720	4,070	3,255
20	-	600	30	65	120	815	1,350	2,720	4,070	3,255

TABLE 3 COCONUTS WITH BEEF CATTLE. (20 ACRES) - CASH FLOWS ($)

Year	Coconuts	Cattle	Total
1	-11,038	-	- 11,038
2	- 1,678	-	- 1,678
3	- 1,952	-	- 1,952
4	- 2,094	-	- 2,094
5	- 1,894	-	- 1,894
6	- 1,794	-	- 1,794
7	- 1,246	-9,665	- 10,911
8	- 202	- 845	- 1,047
9	1,094	1,905	2,999
10	2,066	3,255	5,321
11	3,038	3,255	6,293
12	4,334	3,255	7,589
13	4,334	3,255	7,589
14	4,334	3,255	7,589
15	4,334	3,255	7,589
16	4,334	3,255	7,589
17	4,334	3,255	7,589
18	4,334	3,255	7,589
19	4,334	3,255	7,589
20	4,334	3,255	7,589

3.1.1 Land clearance

Some additional clearance, removal of major stumps and cultivation will be necessary prior to planting pineapple. This work has been charged at $50 per gross acre.

3.1.2 Planting material

The optimum density of planting for intercropped pineapples has not yet been determined. 6,000 plants per gross acre (10,000 per crop acre) has given satisfactory results but higher densities might be preferable. The standard recommendation of 17,000 points per crop acre has been adopted here. At a cost of $9 per 1,000 this costs $160 per crop acre.

3.1.3 Fertiliser

$37 per acre.

3.1.4 Chemicals

$6 per acre.

3.1.5 Equipment

$100

3.1.6 Labour

A charge of $1,000 per annum has been allocated to the pineapple enterprise. With the $250 per annum charged to the coconut enterprise during the immature period, this therefore means that the operator is assumed to work full-time on his holding.

In addition some casual help will almost certainly be required for the first peak harvest in the year after planting. 30-40 man-days have been budgetted for at $200.

3.2 Returns

Grown as an intercrop yields are expected, overall, to be lower than as a monocrop. It has been assumed that yields would drop off in the years following the main harvest as the coconuts grow and shade progressively increases. It has been assumed that the crop would be planted in year 2, i.e. the year after planting coconuts and would be harvested for four years. Assumed yields, per crop acre, are as follows:-

Year	Yield (tons)
3	10
4	6
5	5
6	4

TABLE 4 PINEAPPLES AS A SUBSIDIARY ENTERPRISE - ADDITIONAL COSTS SALES AND NET CASH FLOW ($)

Year	Clearance	Planting material	Fertiliser	Other chemicals	Equipment	Own labour	Casual	Total costs	Yield (tons)	Price per ton ($)	Sales	N.C.F.
1	500	-	-	-	-	-	-	500	-	-	-	- 500
2	-	960	222	36	100	1,000	-	2,318	-	-	-	-2,318
3	-	-	222	36	-	1,000	200	1,458	60	56	3,360	1,902
4	-	-	222	36	-	1,000	-	1,258	36	56	2,016	758
5	-	-	222	36	-	1,000	-	1,258	30	56	1,680	422
6	-	-	222	36	-	1,000	-	1,258	24	56	1,344	86
												3,168
												350

Total yield over the crop cycle is thus 25 tons per acre, compared with 33 tons assumed under monocrop conditions where harvesting continues for five years.

4. COCONUTS WITH COCOA

4.1 Cocoa Introduction

Mature cocoa requires about 35-40 man-days of labour per acre per year, while mature coconut requires 12-15 man-days excluding making copra. It is estimated that when intercropping coconut with cocoa the effective crop acreage of cocoa would be 60 percent of total acreage. Thus a 10 acre holding would have a net six acres of cocoa. The total mature labour requirement would then be 350 - 400 man-days per acre per year which could be supplied by an owner operator with some help from his family.

Since cocoa requires shade it must either be planted with quick growing tree species which will provide the shade, or alternatively planted in shade provided by another crop, such as coconuts. Thus cocoa cannot be interplanted in coconuts until the latter is tall enough to provide adequate shade. It is estimated that under most conditions the coco-nut crop must be seven years old before conditions are suitable for interplanting.

4.2 Costs of Production

The following costs have been used in evaluating cocoa as a subsidiary enterprise on a coconut smallholding.

4.2.1 Planting material

$145 per crop acre.

4.2.2 Fertiliser

Years 1-3 from planting $29 per acre, (200 lb of compound fertiliser + 200 lb lime).

Year 4 onward $42.5 (350 lb of compound plus 200 lb lime)

4.2.3 Chemicals

$100 per acre.

4.2.4 Processing equipment

$500 for initial equipment. Maintenance at $50 per year.

4.2.5 Labour

Operator's labour has been charged to the coconut enterprise at $750 per year. It is assumed that the balance of an annual charge of $1,500 (i.e. $750) is charged to the cocoa enterprise.

4.3 Returns

4.3.1 Yield

To-date yield data from smallholder producers on Rengam and Jerangau soils in Johor are not available. Two sets of yields have been taken:-

Year from cocoa planting	(a) Good	(b) Average
3	200 lb/acre	-
4	400 lb/acre	200 lb/acre
5	800 lb/acre	400 lb/acre
6	1,000 lb/acre	600 lb/acre
7 onward	1,000 lb/acre	800 lb/acre

4.3.2 Prices

It has been assumed that initial coconut planting takes place in 1972. Cocoa is therefore planted in 1978. Prices of cocoa (Supporting Volume 6) have been assumed to decline until 1985 to a level of 55 cents per pound dry beans ex-farm.

4.4 Summary

The costs of the cocoa enterprise, and the returns and net cash flows at both assumed yield levels, are shown in Table 5.

TABLE 5 COCOA - SUBSIDIARY ENTERPRISE - 10 ACRES COSTS, SALES AND NET CASH FLOWS ($)

Year	planting material	Fertiliser	Chemicals	Equipment	Labour	Total costs	Sales - Higher Yield Output lb	Price /lb	Value	N.C.F.	Sales - Lower Yield Output lb	Price /lb	Value	N.C.F
7	870	175	300	-	750	2,095				-2,095				-2,095
8	-	175	300	-	750	1,225				-1,225				-1,225
9	-	175	300	500	750	1,725	1,200	0.62	.744	- 981				-1,725
10	-	255	300	50	750	1,355	2,400	0.60	1,440	85	1,200	0.60	.720	- 635
11	-	255	300	50	750	1,355	4,800	0.59	2,832	1,477	2,400	0.59	1,416	61
12	-	255	300	50	750	1,355	6,000	0.58	3,480	2,125	3,600	0.58	2,088	733
13	-	255	300	50	750	1,355	6,000	0.57	3,420	2,065	4,800	0.57	2,736	1,381
14	-	255	300	50	750	1,355	6,000	0.56	3,360	2,005	4,800	0.56	2,688	1,333
15	-	255	300	50	750	1,355	6,000	0.55	3,300	1,945	4,800	0.55	2,640	1,285
16	-	255	300	50	750	1,355	6,000	0.55	3,300	1,945	4,800	0.55	2,640	1,285
17	-	255	300	50	750	1,355	6,000	0.55	3,300	1,945	4,800	0.55	2,640	1,285
18	-	255	300	50	750	1,355	6,000	0.55	3,300	1,945	4,800	0.55	2,640	1,285
19	-	255	300	50	750	1,355	6,000	0.55	3,300	1,945	4,800	0.55	2,640	1,285
20	-	255	300	50	750	1,355	6,000	0.55	3,300	1,945	4,800	0.55	2.640	1,285