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OPPORTUNITY STUDY FOR COCONUT INDUSTRY DEVELOPMENT IN GENERAL AND COCONUT VINEGAR IN PARTICULAR

UC/SEY/88/181

SEYCHELLES

Terminal report*

Prepared for the Government of Seychelles
by the United Nations Industrial Development Organization

Based on the work of T.K.G. Ranasinghe, expert in coconut processing industry

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* This document has not been edited.

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Explanatory notes

The currency exchange rate as at 18 January 1989 was

US Dollar 1 = Seychelles Rupees (R) 5.55

Acronyms :-

MND	-	Ministry of National Development.
TSS	-	Technological Support Services Section of MND.
IDC	-	Island Development Company Ltd.
SADECO	-	Seychelles Agricultural Development Company Ltd.
SODEPAK	-	Soap, Oil and Detergent Packaging Industries Ltd
SMB	-	Seychelles Marketing Board.

Note : IDC, SADECO, SODEPAK and SMB are parastatal organizations.

Abstract

This report deals with findings and recommendations of a UNIDO mission to the Republic of Seychelles to investigate the opportunities available for development of coconut based industries in general and production of coconut vinegar in particular.

At present, there are several small scale uses of coconut based products and in this regard, the planned change to use copra cake instead of copra for animal feed should be effected, the manufacture of laundry soap with coconut oil should be continued, the refining bleaching and deodorization plant should be recommissioned for making edible oil with 50% coconut oil, and finally, the proposed coconut cream project should be pursued.

There is a need as well as scope to improve the copra processing industry and in this regard, the consultant recommends research and experimentation work be undertaken for technical and economic improvements to the copra dryers.

A small vinegar project using coconut toddy has been found to be viable and is recommended.

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1. INTRODUCTION

1.1 Objective of project

The long term objective of this project UC/SEY/88/181 is to develop coconut (resource) based industries to create more livelihood opportunities, enhance import substitution and generate more foreign exchange through exports.

The immediate objective is to assist the Government in identifying opportunities for development of coconut based industries in general and the production of coconut vinegar in particular.

1.2 Background

The Republic of Seychelles comprises of 33 granitic and 60 coralline islands and some elevated reefs in the Indian Ocean about 1000 km outside the east coast of Africa between the latitudes 4 degrees and 10 degrees south of the equator. As the archipelago is widely scattered, the Republic of Seychelles controls over 1 million km^2 of ocean compared to 455 km^2 of total land area. The major islands which are granitic, are gathered around the main island Mahe, which is 29 km long and up to 11 km wide. The granitic islands are very mountainous with rock outcrops, leaving relatively small areas of arable land. The Republic has a population of 60,000 people.

During the 1950s more than 25% of the land area was under coconut, 8500 ha on granitic islands and 2700 ha on coralline islands. The situation has since changed as most of the coconut land in the inner and outer islands has been either neglected or abandoned with the agricultural labour migrating to Mahe for more attractive jobs whilst the plantation owners themselves moved over to Mahe to venture into more lucrative avenues such as tourist hotels etc.

Copra has been the main product of the coconut and annual exports of 6000 tonne in the 1950s and 1960s have gradually declined to a level of 3000 tonne in 1980 and only 1,800 tonne in 1986. Up to the 1970s, copra exports represented the principal export earnings and with the gradual loss in value and quantity, the export earnings in 1986 represented only 28% of the earnings of all commodities.

The Government is now keenly looking into other avenues of coconut processing and particularly coconut vinegar from sap as all requirements of vinegar are presently imported. The Ministry of National Development which is charged with the responsibility for industrial development has set up a small laboratory scale operation for the production of coconut vinegar at the Technological Support Services Section of the Ministry.

The Government has sought the assistance of UNIDO to provide the necessary assistance in making this opportunity study for the development of the coconut processing industry with particular reference to the setting up of a coconut vinegar factory.

Accordingly, a Consultant on coconut processing industry has been assigned to the Ministry of National Development for a period of 2 weeks to provide the necessary assistance.

1.3 Terms of reference

The Consultant has been required to carry out an opportunity study on the various possibilities that exist for the development of the processing industry in general and in particular for the production of coconut vinegar. The specific tasks to be carried out by the Consultant were :-

* Review the coconut production sector in the Seychelles and the utilization of the existing coconut potential by the processing industry;

- Review the existing coconut processing industries with regard to the products produced and their marketing as well as it's capacity utilization;

- Study the existing possibilities of coconut sap production and its impact on the raw material supplies for other processing industries;

- Outline the techno-economic criteria for the production of vinegar from coconut sap in comparison with other coconut processing operations and define its implications on the coconut industry in general;

- Outline the technological parameters for the production of coconut sap and the production of vinegar from coconut sap, define relevant vinegar production capacities and estimate the investment and production costs;

- Prepare a terminal report outlining assessments, evaluations, conclusions and recommendations.

1.4 Methodology

The Consultant visited the Republic of Seychelles from 11 to 23 January 1989 to undertake this study. The methodology adopted was as follows :-

- Hold discussions with key personnel - a list of persons met and visits made is given in Annex 1.

- Review relevant studies, statistics, and gathering of data.

- Discussions with the Government counterparts on the conclusions reached and recommendations made.

- Preparation of report.

The Consultant was assigned to the Ministry of National Development and the Technological Support Services Section of the Ministry. The Counterpart was Mr. Radley Weber, Director of Technological Support Services Section.

1.5 Acknowledgement

The Consultant wishes to acknowledge the excellent arrangements made by Dr. Selwyn Gendron, Director General of Industry in the Ministry of National Development for the Consultant to undertake this study. The active support and cooperation of the Counterpart Mr. Radley Weber, Director, the Research Officer Miss Bernella Micock and other staff of TSS Section made the task of the Consultant much easier and this too is gratefully acknowledged.

2. RECOMMENDATIONS

2.1 In order to increase export earnings and to reduce cost of production of copra to viable levels, improvements to the design and operation of copra dryers are necessary and the Consultant recommends that research/experimentation as detailed in section 4.5 be undertaken to improve the existing dryers.

2.2 The Consultant recommends that the planned change to use copra cake instead of copra directly for blending animal feed should be pursued, manufacture of coconut oil based laundry soap should be continued, the refining, bleaching and deodorization plant should be recommissioned to manufacture edible oil by blending coconut oil and palm olein, and lastly; the proposed coconut cream project should be pursued to enable earn a high export value per nut.

2.3 The small coconut vinegar project as detailed in chapter 5 is viable and is recommended.

2.4 A visit of 1 week duration by the officer responsible for the coconut vinegar project; to a commercial plant in Sri Lanka or elsewhere is recommended.

3. COCONUT PRODUCTION AND UTILIZATION

3.1 Coconut production

Information on areas of coconut cultivation or yields of coconut in the different islands is not available. The potential coconut production in each relevant island/atoll has been estimated by the author in Annex 2, based on a probable percentage of land area to be on coconut and an overall yield of about 0.75 tonne copra per ha. This yield is low compared to other coconut producing countries (say 1 tonne copra per ha) and the assumption of this figure is due to the prevailing poor condition of coconut lands as a result of them being neglected or abandoned during the last few years due to the migration of both the owners and workers from the outer islands to the main island, Mahe.

The potential coconut production estimated in Annex 2 is about 6944 tonne copra equivalent with about 2885 tonne copra equivalent (or 41%) from Mahe.

3.2 Household consumption

The household (or domestic) consumption of coconut is negligible due to changing habits of the Seychellois who rarely consume any coconuts today. A few coconuts are used to feed pigs reared by the households. The requirements of cooking (frying) oil are met entirely from imported vegetable oils such as corn oil and palm olein.

In the years gone-by, there has been a significant per capita consumption of about 150 nuts per annum, as indicated in the "Report on the Coconut Industry" by F C Cooke (1958).

3.3 Exports of coconut, copra and oil

Exports of coconut, copra and coconut oil for the years 1975 to 1987 are given in Annex 3.

The exports of copra used to be in the region of 6000 tonne per year in the 1950s and 1960s, and then gradually decreased to around 3000 tonne in the 1970s and to 2000 tonne or less in the 1980s (as seen in Annex 3) Copra exports have been mainly to Pakistan where the cup copra is utilized for edible purposes and milling grade for extraction of oil. The present export prices C & F applicable to the shipment being effected in January 1989 are USD 805 and USD 485 for cup and milling grades respectively. The freight component is USD 65 per tonne.

Export of fresh nuts to Mauritius and France have gradually declined as illustrated in Annex 3, and there were no exports at all during 1987 and 1988 due to high cost of nuts.

Coconut oil exports too have declined and ultimately ceased in 1986, once again due to high local costs compared to the depressed world market prices.

3.4 Copra production

Production of copra in different islands/atolls is not recorded and the only published data relates to export volumes of this product (Annex 3). However, it was possible to obtain data on inspection of copra originating from different islands/ atolls for export from the records maintained by the Director, Pests & Disease Control.

Annex 4 provides information on the origin of cup copra inspected for export, Annex 5 that of milling copra whilst Annex 6 gives the averages for all copra for the period 1984-88.

Small amounts of copra (milling grade) are being crushed to produce some coconut oil and copra cake. The amounts do not exceed 100 tonne of copra per year at present.

3.5 Pattern of coconut utilization

Pattern of coconut utilization is illustrated in Annex 7. As the main use is to manufacture copra and there being no other significant use, the present utilization may be only about 25% of the potential.

The reason for the poor utilization of coconut, as stated earlier, is due to neglect or abandoning of coconut land in the outer islands. The poor utilization of coconut produced in Mahe is due to the prevailing poor prices of coconut products in the world market which has resulted in cost of collection and processing copra uneconomical. Furthermore, during the last few years prime coconut land in Mahe has been utilized for development of housing, hotels and infrastructure which has actually reduced the potential for coconut production.

4. COCONUT PROCESSING AND MARKETING

4.1 Institutional aspects

Seychelles Agricultural Development Company Ltd (SADECO) has a monopoly on copra processing on the main island Mahe in addition to managing some large government farms.

Island Development Company Ltd (IDC) has a monopoly on coconut production and copra processing on islands other than Mahe. IDC's functions and responsibilities are the integrated development of the islands. At present about 9 important islands have been handed over to IDC. In the rest of the islands, coconut production and copra processing remain in the hands of the private sector.

Copra and other coconut based products are exported and or locally marketed by Seychelles Marketing Board (SMB). SMB is the most important organization in the economic development of Seychelles. It has been established to ensure orderly production and distribution of all the goods the country consumes. The Board has a monopoly on all exports, imports and local marketing in Seychelles.

Soap, Oil and Detergents Packaging Industries Ltd (SODEPAK) is a government venture with foreign (German) collaboration for manufacture and packaging soap, edible oil and detergents.

All the above described institutions are owned and managed by the government. In the case of SODEPAK the foreign collaborator is represented in the management of the business.

4.2 Processing and marketing activities

According to information available on export of coconut products (Annex 3), copra exports have, over three decades, declined

from 6000 tonne per annum to 2000 tonne or less in the 1980s. Furthermore, as explained in section 3.3, the exports of small quantities of oil and freshnuts have also finally ceased by 1987. There being hardly any domestic consumption of freshnuts, (section 3.2) and very little use of oil or cake, copra manufacture is the only major processing activity in Seychelles. This is discussed in detail from section 4.3 onwards in this chapter.

SMB uses about 5 tonne copra per month at present as a raw material in the manufacture of animal feed in a modern feed mill of Belgian origin installed recently with foreign knowhow. The ultimate aim however is to use copra cake as it is wasteful to use copra directly. For this purpose, an used oil expeller from the outer islands has been brought to Mahe for installation and operation by SMB to obtain copra cake and oil. SADECO crushes about 3 tonne of copra per month at their farm at Anse Aux Pins, with a very old chekku type crusher which is powered by an old diesel engine. The oil is sold to SMB who then sells it to SODEPAK, and the copra cake is used by SADECO for feeding their own animals.

SODEPAK uses about 2 tonne of coconut oil a month to manufacture around 3 tonne of laundry soap based on 100% coconut oil; employing the "cold process". This meets the entire needs of the country as no laundry soap is imported. SODEPAK had been in the process of installing an oil refining, bleaching and deodorizing plant (of 7 tonne per shift capacity) and a small but sophisticated toilet soap plant (4 tonne finished soap per shift) when the factory caught fire in September 1988. There had been plans to initially blend about 30 tonne, a month refined coconut oil with an equal amount of imported palm olein for marketing an edible oil, and gradually replace all imported edible oils amounting to 1200 tonne per annum. SODEPAK possesses all the technical knowledge required,

being a joint venture with a foreign party in the soap business but there is uncertainty whether the plant would be reconstructed.

According to the National Development Plan 1985-89, there were plans to set up a desiccated coconut factory in Mahe but subsequent investigations had revealed it to be unviable.

Presently, the MND is pursuing a proposal by a French firm to set up a coconut cream project. Equipment, technology knowhow and an export market will be brought by the party who are also willing to contribute equity. Preliminary and detailed studies will be carried out by the foreign party.

As regards the small scale uses of coconut given above, the Consultant recommends the following :-

(1) The planned change to use copra cake instead of copra directly for animal feed should be pursued as this will mean a much higher use of coconut as copra cake.

(2) Manufacture of coconut oil based laundry soap should be continued as this soap lathers in brackish or even sea water (essential for coralline islands).

(3) The refining, bleaching and deodorization plant should be recommissioned for the planned production of edible oil containing 50-50 coconut oil and palm olein as planned. The oil will come from the proposed oil milling operation of SMB where the cake will be used for blending animal feed.

(4) The coconut cream project with the French party should be pursued as the export value per coconut will be several times compared to copra.

4.3 Copra grading

As already described in section 3.4, copra production data based on copra originating from different islands/atolls for export purposes; is given in Annexes 4 (cup grade), 5 (milling grade) and 6 (averages for all grades). The percentage of copra to all grades for Mahe, rest of the islands and total Seychelles for the years 1984-88 have been derived as hereunder, based on Annex 6 :-

	Cup Copra(t)	Milling Copra(t)	Total (t)	% Cup to total
Mahe	431.1	153.0	584.1	74
Inner/Outer islands excluding Mahe	676.9	467.8	1,144.7	59
Total Seychelles	1,118.0	620.8	1,728.8	65

For Mahe, the percentage of cup copra is 74%, the rest 59% and for Seychelles as a whole, it is 65%. This is of great importance as the export prices are significantly different. As mentioned in section 3.3, the FOB prices of cup and milling copra for the shipment due in January 1989 are USD 740 and USD 420 per tonne (after deducting freight cost from C & F prices).

In each batch of copra produced in the dryer, some is graded as cup copra whilst that which does not meet the required quality is graded as milling copra. The yield of cup grade would depend upon (1) the design of the dryer, (2) the operating techniques and (3) on the control and management of the operation.

4.4 Copra processing

There is basically one type of copra dryer (or copra kiln or calorifer) in Seychelles with slight size/capacity variation as seen in Mahe during visits made. A photograph of a typical dryer in Mahe is illustrated in Annex 8. These dryers are the indirect heat - natural draft hot air type.

The overall dimensions of a kiln building would be 9 m long x 5.5 m wide in plan, with 3 m high walls of granite or coral stone at the top level of which the upper wooden floor is constructed. The upper storey has 1.5m high walls at eaves and 2.5 m walls at the apex of the roof. The roof and the upper storey walls are made of corrugated aluminium or galvanized iron sheets.

A large flue pipe of upto 0.9m (3 foot) diameter is placed along the length of the building at the centre. This flue pipe acts as a heat exchanger and is constructed of mild steel sheet of about 3 mm (1/8 inch) thickness and protrudes out of the building at either end. At one end solid fuel is burnt for heating and at the other end it is connected to a vertical chimney for exhaust of combusted gases.

On either side of the ground floor along the length of the building, there is a series of about 5 shelves one on top of the other with a gap of 0.4 m in between and 1.2 m width. The shelves have wiremesh bottoms to hold the copra. There are usually no shelves on the upper floor but some dryers have a few shelves.

The cost of construction of such a dryer at today's prices would be about R 100,000 (USD 18,000). Existing dryers in Seychelles have been constructed considerable time ago and are fully amortized. They could however be used for many more years by replacing the heat exchangers and chimneys from time to time.

The capacity of the dryer being about 6000 nuts (0.857 tonne copra) a day, this quantity of husked nuts will be cracked open each morning and placed on the shelves of the ground floor towards the firing end. The firing end half of the dryer is the hottest area on the ground floor. The dryer is fired with coconut shells of the previous batch and firewood by mid-day when the dryer is loaded fully. Fuel is added gradually until about 6 pm and thereafter allowed to cool. By morning next day, it would have cooled down adequately to enable workers to transfer the partially dried copra (with shell intact) from the firing end half to the cooler half of the dryer on the ground floor. The firing is repeated on the second day but with a new load at the firing end half of the dryer, just like on the first day. On the third day, the copra cups from the cooler end are unloaded, shells detached and transferred to the upper floor for the final drying. On the fourth day the copra is unloaded, cleaned, inspected/sorted for grading and bagged. The cups graded as cup copra are trimmed before bagging to improve appearance.

Some dryers take more than 3 days (4 or 5 days) to complete the drying down to 6-8% moisture.

4.5 Improvements to design and operation of dryers

As discussed in section 4.3, higher yields of cup copra would depend upon (1) design (2) operating technique and (3) control/ management of the dryer operation. This section deals with aspects (1) and (2) as there is scope for improvements through research/experimentation.

The following are some observations and comments on the design and operation of dryers in Seychelles, presented in the order of decreasing priority; for action :-

* The copra load is not directly above the flue tube (heat exchanger) to utilize the upward hot air flow (convectional) for effective drying; which technique is used in all natural draft dryers. This region is presently too hot in the dryer. Temperature measurements have to be made at various positions to know of the exact problems. Insulating the firing end half of the tube should be considered.

* The copra has to be shifted from the firing end half of the dryer to the other half on the second day as the firing end half is too hot. The insulation of the firing end half of the tube as described above; combined with a return flue pipe (u shaped) and reduced fuel usage will enable more uniform temperature along the length of the dryer. If this can be achieved, the labour for shifting the copra on the second day can be reduced. If the temperature can be maintained properly the copra load can also be placed above the heat exchanger.

* Use of a forced draft system. Another approach to improving distribution and control of temperature would be to use a forced draft system (with fans) to remove heat from the hottest area but, this would apply if electric power is available near the dryers. If the drying time is reduced drastically, there could be considerable saving on labour and fuel after meeting the cost of electricity.

* There is no proper ventilation for escape of moisture laden air at the top of the lower or upper storeys, and entry of a corresponding amount of fresh air. Relative humidity should be measured at key positions particularly on rainy days and cool evenings. If air is saturated with moisture, then no drying is possible but only "cooking" and "steaming" of the copra and besides, moisture will be reabsorbed during cooling. Jack roofs, openings below eaves etc., are necessary.

* Delay between opening nuts and drying. At present, those nuts that are cracked open first thing in the morning would have to wait about 4 hours till noon when the dryer is fired after loading fully. This delay should be avoided as the kernel begins to deteriorate from the moment it is opened, by the attack of micro organisms resulting in discoloration of the copra. It is preferable to reallocate labour in a manner that all nuts are opened and loaded for commencement of firing within about 2 hours particularly if the yield of cup copra is to be increased.

* Very high labour content (as shown in section 4.6) in processing and it's reduction is essential by eliminating excess work caused by unnecessary design features or improper operating methods.

* There is no proper furnace to burn the solid fuel and to direct all the combusted hot gases into the flue tube. A proper furnace will save fuel and also increase life of the tube at the firing end.

* The vertical chimney also could be inside the dryer building for additional heat exchange as per the case with the new dryer at Anse Aux Poules Bleus, southwest of Mahe.

* The volume and surface area of the dryer appears to be excessive for the capacity of the dryer, leading to high heat requirements/losses for operation. The dryer must be more compact.

If the percentage of cup copra exports to all copra can be increased for the country from 65 to 75%, then the increased foreign exchange earnings for a volume of 2,000 tonne at the current FOB price levels of USD 740 and USD 420 per tonne for the two grades would be USD 320 x 200 = USD 64,000 which is substantial.

4.6 Cost of copra production

From available information with SADECO, the cost of production for the typical dryer detailed in section 4.4 is calculated as follows on a per coconut basis :-

	Cents
Cost of 1 coconut	20
Labour for processing (cracking, loading, rearranging twice, unloading, cleaning, inspection/sorting, trimming and bagging).	30
Bags per nut	02
Fuelwood	03
Transport	05
Management overheads	06
Total cost per nut as copra	66 Cts.

The cost per Kg (7 nuts) of copra = R 4.73

The payments received per Kg of copra by SADECO from SMB (who export) is R 4.00 for cup grade and R 2.40 per kg for milling grade.

The cost of production (above) corresponds to R 4,730 or USD 852 per tonne, which is above the present FOB price earned for cup copra. The need exists for technical and economic improvements for the performance of the dryers and the Consultant is of the opinion that there is ample scope (based on section 4.5). The Consultant recommends that Research/experimentation work be undertaken to improve technical and economic performance of the dryers.

4.7 Copra marketing

According to present arrangements, all copra produced by SADECO, IDC and private farmers must be sold to SMB. As stated earlier, all copra exports are carried out by SMB.

Export of copra etc., by volume is given in Annex 3 and the decline in exports is discussed already in section 3.3. The value of exports and unit value for copra etc., are given in Annex 9. It can be seen that unit values of exports have declined to very low levels for copra during 1986 and 1987 (23 and 10 cts) and small amounts of coconuts and coconut oil earlier exported have ceased completely. The decline of the world market has affected export of coconut based products in all coconut producing countries. This has however, since recovered and current export prices of copra for the two grades as detailed in sections 3.3 and 4.3 are much more favourable.

5. OPPORTUNITY STUDY FOR PRODUCTION OF COCONUT VINEGAR

5.1 Project background

The Technological Support Services (TSS) Section of the Ministry of National Development (MND) has been experimenting on production of vinegar from coconut sap (toddy) using the various technologies recorded in the UNIDO/APCC Coconut Processing Technology Information Documents Part V "Domestic Coconut Food Processes" (UNIDO/IOD 377/Add 4). A laboratory scale pilot project using the "Generator Process" (Technology sheet V/36) was able to produce vinegar of fairly good quality.

The success of this pilot project has prompted TSS to promote a small scale project with two objectives firstly, to utilize local raw material (coconut toddy) and secondly, for import substitution as all vinegar consumed in Seychelles is imported.

Some preliminary studies have been carried out by TSS (internal document dated 6 November 1986) to describe the concept, outline and justification for further work on the project because data on vinegar imports had revealed scope for import substitution using local raw material.

5.2 Description and uses of vinegar

Vinegar can be of two types - Natural or Artificial

Natural vinegar can be defined as a condiment made from watery solutions of sugar or starchy materials by two separate microbial processes. The first is an alcoholic fermentation of naturally occurring (or converted) fermentable sugars by a certain species of yeasts called Saccharomyces. The second is the oxidative fermentation of alcohol, produced by a species of bacteria called Acetobacter. Owing to the fact that a wide variety of sugary or starchy sbustances can be used for the production

of vinegar, it's exact composition will depend on the raw material that has undergone these fermentations, apart from the actual conditions of manufacture, aging and storage. Essentially however, the finished product is a dilute solution of acetic acid (4 to 8%) containing salts and extracted matter from the source material and certain aromatic minor constituents produced during the fermentation. The term vinegar itself, is of French derivation, signifying 'sour wine'. Most natural vinegars are made from rice, grapes, apples and other fruity or starchy substances as a byproduct of alcohol based drinks which go sour through acetification. In coconut producing countries where the unopened spathe (flower) is tapped for sap (toddy or tuba), sour toddy after 2 or 3 days is used as vinegar for seasoning fish, fruits and vegetables and this is already known in Seychelles. In Sri Lanka, natural vinegar is produced commercially from coconut toddy by small scale industries.

Artificial (or spirit) vinegar containing acetic acid of 4 to 13% strength is also produced commercially by diluting food grade acetic acid and adding colour and flavour as desired. This is much cheaper than natural vinegar. Concentrated vinegar of 60% strength is also marketed particularly for hotels and large scale users such as in food preservation. This is diluted to about 10% or as desired and used just like the natural vinegars.

The main uses of vinegar are as a flavouring ingredient in food preparation and for the preservation of fruits and vegetables by conversion to pickles, chutneys and sauces. These uses are for both household and commercial purposes.

5.3 Market and plant capacity

Information pertaining to volume and CIF value of vinegar imports for the years 1982 to 85 (as per Trade Report 1985) is given below: -

Year	1982	83	84	85
Volume (litre)	14,130	23,579	23,119	25,000
Value (R)	203,072	248,460	25[illegible],334	270,000
Unit value R/l	14.37	10.54	11.13	10.8

During the above period, the imports have comprised of both natural and artificial vinegars which have widely differing values.

The imports of vinegar and substitutes for 1986 by origin (as per Trade Report 1986) are given below :-

Origin	Quantity (kg)	CIF Value (R)	Unit Value(R/l)
France	36	529	14.69
South Africa	9,320	50,173	5.38
UK	5,338	82,257	15.41
USA	11,395	108,563	9.53
	27,089	241,522	

Note 1 kg = 1 litre for vinegar

From the above two tables, it can be seen that the current requirement of vinegar is about 30,000 litre per year. The unit value of imports of around R 15/litre from France and the UK indicate natural vinegar whereas those from South Africa and the USA represent artificial vinegar.

The import duty on vinegar (whether natural or artificial) is 50% on the CIF value and hence the unit value of natural vinegar after duty will be R 22.5/l.

Information on typical brands of vinegar presently marketed in Seychelles is given in Annex 10. The retail price for natural vinegar made from wine is about R 35 per litre and the artificial vinegar about R 6.50 per litre. This shows that artificial

vinegar is heavily subsidized and if this was not the case, artificial vinegar should be retailed at R 10 to 15 per litre.

All above brands of vinegar were packed either in clear glass bottles or clear polyvinyl chloride (PVC) food grade bottles. Before PVC bottles became popular, only glass bottles were used in the years gone-by. The most common pack sizes are 500 ml and 750 ml.

The demand for any brand would depend upon two important factors - price and flavour. The artificial vinegar appears to have an enormous price advantage not only on the per litre basis but also because of the strength (of 60%) which gives a volume of 8 times when diluted to a strength of 7.5% in the households. However, the flavour (and odour) of the artificial vinegar does not seem to be able to match the natural vinegars.

Recent studies carried out by the TSS Section of MND have shown that 10% of vinegar imports in the immediate past have been natural vinegar.

Therefore, for the purpose of the coconut vinegar project, the demand will be taken to be 10% of 30,000 litre which is 3000 litre per year, assuming that this will replace all the imported natural vinegar.

The capacity of the project will be 3000 litre of natural vinegar per year. Assume 10 months production only per year as the palms could be rested for two months for the dry season. Monthly output will be 300 litre.

Since there are two generators, each generator will produce 150 litre per month. Each semi-continuous batch will take up to 3 weeks and each generator will be of 200 litre capacity to ensure an output of at least 150 litres per month.

Toddy requirements will be 400 litres per month which is 200 litres for each generator. Toddy will be collected from 20 palms at 2 litres per palm (40 litres per day) for 5 days (1 week) for each generator once a month. The yield of vinegar will be 75% of toddy input.

5.4 Material inputs

Coconut toddy by itself is an excellent raw material for the manufacture of high grade vinegar. It needs no fortification with adventitious sugar or salts and possesses the overriding advantage of being a well balanced medium containing sufficient nutriment for the growth and activity of yeasts and bacteria. Tapping of toddy from the coconut palm is already known to the people of Seychelles as is the case in most coconut producing countries. In fact, in Mahe as well as inner and outer islands, people tap toddy in a couple of trees for their own consumption. There was a licence fee of R 50 per tree per year for tapping until 1986 and thereafter the licencing has been abolished.

For the pilot project, toddy was tapped from the young hybrid palms at the SADECO farm at Anse Aux Pins which is about 8 km south of the Airport in Mahe. For the proposed project, toddy will be obtained by tapping 20 palms from this same farm, and the vinegar project will also be located at this farm. Mention must be made here of the need for a high level of management control and security over the tapping operation on a large farm to ensure that there is no pilferage or direct consumption by the workers.

The tapping of 20 palms for the project has insignificant impact on coconut production. Even the estimated 5,000 odd palms presently tapped by private individuals for their own use or sale in Mahe corresponds to only 25 ha of coconut land or 19 tonne copra equivalent.

Based on yield of toddy per palm in various countries and the data observed during the tapping operation for the pilot project, a figure of 2 litre per palm per day average has been assumed for this project.

Therefore, the daily collection of toddy will be 40 litre from the 20 palms. There will be 2 batches per month, each batch requiring 5 days x 40 litre toddy. The monthly requirement of toddy will be 400 litre and the annual requirement (for 10 months) will be 4,000 litre.

Utility requirements will be a source of 5 kw power supply, with a monthly power consumption of 100 kwh. The cost of electric power per month will be R 158. Water requirement per month will be about 15 cubic m. The cost of pipe water will be R 31.65 per month.

5.5 Location and site

As already described in section 5.4, the location of the project will be at the SADECO farm at Anse Aux Pins which is about 8 km south of the Airport in Mahe. There are several reasons for selecting this site for the project. They are :-

* The supply of toddy will be at a reasonable economic price rather than the commercial price in Mahe.

* Final bottling will be done at SMB Agroindustrial Division (which is close by) with equipment already available.

* Government Policy is to have para statal organizations undertake such projects and in this regard, SADECO already owns several coconut plantations in Mahe and the farm at Anse Aux Pins is the most convenient. Besides, toddy for the pilot project had already been tapped from young hybrid palms from this farm and thus the tapping exercise itself will be quite easy without having to climb tall palms.

5.6 Process description, quality control and equipment (project engineering)

The semicontinuous process known as the "Generator" process in Sri Lanka (and called the Orlean process in Europe) will be used for this project. The Technological Support Services Section of MND has already set up a 90 litre capacity generator in their laboratory, based on the UNIDO/APCC "Coconut Processing Technology Information Document" (UNIDO/IOD. 377/Add.4) - Technology sheet V/36 - "Vinegar from coconut sap (toddy) using generator process." This pilot plant has been very successful as good quality vinegar at about 7.5% strength has been produced and the staff already dealing with this matter is quite conversant with the process and technology. However, a visit to a commercially operating project in Sri Lanka or elsewhere will be important to learn the finer points of the business.

The "Generator process"

The vinegar generator is designed to provide the maximum surface exposure for a volume of vinegar stock (vide infra) in order to supply enough air for acetic acid bacteria to efficiently and quickly oxidise the alcohol to acetic acid.

The principal components of a generator essembly comprise of a feed (or supply) vat, an acetifier and a receiving trough. Annex 11 gives an illustration of a commercial scale vinegar generator used in Sri Lanka for producing 680 litre (150 gallons) per batch. For the project in Seychelles, two generators of 200 litre each will be used. In essence, the generator is a countercurrent gas absorber wherein the acetic bacteria cause the oxidation of alcohol to acetic acid. Air for the alcohol oxidation is admitted to the generator below the false bottom through the eight air vents and it circulates naturally owing to the heat of oxidation in the packing.

The vinegar stock from the feed vat is uniformly sprayed over the surface of the inert porous medium or packing material (maize cobs in this case) at the surface of which the oxidation takes place. The stock which drains off from the packing by gravity into the base of the generator is run out and pumped (or poured) back into the feed vat, from which it is recycled till acetification is complete.

The ordered sequence of processes in the manufacture of vinegar from coconut toddy are relatively simple and can be operated at low cost. The process flow diagram is given in Annex 12.

Fermentation vats: A series of 5 conical shaped wooden vats of 40 litre capacity is required for fermentation of toddy into alcohol without any acetification taking place. The toddy is properly filtered before charging the vats. The design should be such that air supply is limited. The vats should be kept full to minimise air inside and the covering should be loose so as to permit exit of carbon dioxide formed during fermentation.

Feed vat: This is a simple conical wooden vat with a capacity of 200 litre capacity (2 Nos. for alternative use for the project). To minimise evaporation losses, there must be a firm cover on top with an opening of about 300 mm diameter and a lid to cover this opening. The vat should have a gauge to indicate liquid level and a glass tap connected by rubber tubing to the acetifier to regulate the feed rate.

Acetifier: This is the vital part of the assembly. It is a conical wooden vat about 1.5 meter high with three superimposed compartments, separated by perforated shelves.

The upper compartment (or dispersion chamber) contains the distribution apparatus which insures even application of the vinegar stock over the generator packing material. The central compartment (or packing chamber) contains the supporting medium

which offers the necessary surface area for the active growth of vinegar bacteria and their contact with air. The lower compartment (or collection chamber) serves as a sump for the collection of the vinegar. It also contains 9 ports for the admission of air, and an exit cock or faucet for drawing off the vinegar.

Receiving through: This is an open wooden vessel for collecting the vinegar that is run off from the acetifier. This receptacle is only for temporary storage, and is particularly useful during the recirculation operations of the vinegar stock.

Accessory equipment: In operation, the vinegar stock has to be distributed uniformly and intermittently over the generator medium in small but constant amounts. An automatic feeding device therefore becomes essential. Though a stainless steel revolving sprinkler (or sprayer) is ideal, an automatic wooden tilting trough located in the dispersion chamber and resting on the top perforated shelf is good enough.

A thermometer graduated to 100°C and fitted by means of a rubber bung into the packing chamber, is useful, especially when the generator is being seeded and started off. Thermometers fitted into the dispersion and collection chambers are also useful but not essential. Though a stainless steel centrifugal pump for recycling the vinegar stock is the best arrangement, this operation could also be done manually. For this purpose stainless steel (or aluminium) receptacles alone should be used. Six pot shaped vessels with a capacity of about 4 litre each would be required for working a single generator.

Aging casks or barrels: These are wooden casks of barrels for aging the vinegar for periods of 3 to 6 months.

Working drawings and all details of the equipment and accessories are given in the UNIDO/APCC technology information sheet V/36.

Vinegar stock: The preparation and (if necessary) blending of suitable alcoholic liquor (fermented toddy in this case) constitutes the first stage in the process. The term 'vinegar stock' is popularly assigned to this alcoholic wash.

As the quality and composition of the toddy used are as important as the details involved in the manufacturing process, it is important that care should be exercised in its collection and handling. A system of graduated straining is useful to remove suspended impurities. Wicker baskets may be used at the tapping points for removing foreign matter (including bees, wasps and other insects) from the toddy, before it is bulked in casks. On reaching the factory the finer suspended matter may be removed, by passing through 'staybrite' steel wire meshes of different gauge, and ultimately through cloth, into the fermentation vats. Toddy filtered this way will be found to be agreeable in taste and smell and will also be quicker and smoother in fermentation than the unstrained material.

To ensure an economic conversion of sugar to alcohol and to obtain a better quality vinegar stock, control of the alcoholic fermentation is desirable. If acetic acid is produced in any quantity, the fermentation may cease before all the sugar has been converted. A concentration of 0.5 per cent acetic acid markedly diminishes the activity of the yeast and higher concentrations will completely inhibit the alcoholic fermentation.

Seeding the generator: When a sufficient quantity of vinegar stock has been accumulated the acetifier may be seeded with vinegar bacteria. To do this, maize cobs (after removal of seeds) which have been previously cleaned, washed and dried are soaked in good unsterilized vinegar for about 6 hours and packed fairly loosely in the packing chamber of the acetifier between the two perforated shelves. It is a good plan to pack the bigger cobs at the bottom and the smaller ones near the top. This arrangement would facilitate the free circulation of air even after the growth of bacteria film over the cobs.

Operation after seeding: Once the generator is seeded, its operation consists in recirculation at a regulated rate of flow; each batch of vinegar stock through the packing, and controlling the air supply by opening one or more air vents, until, the alcohol is oxidised. If too much air is allowed to enter, there can be over-oxidation of the alcohol resulting in wasteful loss of acid.

Aging: When the vinegar has reached its maximum strength it must be aged before it is bottled, and is at its best quality for table use. The aging is done in wooden maturation casks or barrels that are kept full and closed, so that destruction of acid by oxidation by the vinegar bacteria does not occur.

During the period of aging which could range between 3 to 6 months, a certain amount of sedimentation takes place which improves the appearance and clarity of the vinegar.

Quality control

For checking the quality of the raw material and the efficiency of acetification some form of analytic control is essential. For this purpose simple titration apparatus comprised of a 25 (or 50) ml burette with stand, a 5 or 10 ml pipette, about 6 x 250 ml titration flasks, and a wash-bottle would be required.

An alcoholmeter (or ebulliometer) with a stainless steel boiler and inner condenser tube, covering a range of 0-12 per cent alcohol by volume, is also an essential prerequisite.

Equipment costs and sources

Fermentation vats	40 litre capacity x 5 Nos.	) To be
Feed vat	200 litre capacity x 2 Nos.	) locally
Acetifier	2 Nos.	) fabricated
Receiving trough	2 Nos.	) as for pilot
Accessories		) project
Aging casks		)

Quality control equipment - available with TSS

The total cost of the equipment is estimated at R 15,000.

Factory building

The location of the project will be the SADECO farm at Anse Aux Pins, 8 km south of the Airport. At this location, the toddy will be tapped and the finished vinegar will be in bulk for transfer to SMB Agroindustrial Division where packaging equipment is available. At SMB, the artificial vinegar project (dilution operation and filling) will operate along with another project for the manufacture of pickles, chutneys etc., using the artificial vinegar.

A building 10.6 m x 6 m (35' x 20') is proposed for the project. This will have more than sufficient space for all the operations. The height of the building at eaves will be 4.5 m (15'). Dwarf side walls of 1.6 m (5'6") along the length of the building with a mounted wooden trellis reaching to the roof level should be made. The roof should have a ceiling to keep the atmosphere cool and also to prevent contamination from dust and falling debris. Annex 13 provides a drawing of the building.

The floor of the building where liquid may splash; should have a permeable stratum. Clean white river sand is used to facilitate rapid soaking up of splashed liquid.

Provision should be made for entry of diffused daylight, and ample natural ventilation to facilitate removal of stagnant air and fermentation gases. Trellis work on two sides of the building (as suggested above) should be suitable.

The cost of the building will be (63.6 m^2 @ R 1000) = R 63,600

When the factory is being built, every source of infection, such as manure heaps, decomposing materials and rubbish heaps

of debris, should be avoided, as they can act as a source of wild organisms which can infect the raw materials and vinegar in the factory.

Cleanliness is of prime importance; for, the generators provide an excellent breeding place for flies and other vermin which is unhygeinic and can reduce yields and output to a very marked degree.

A supply of fresh potable water should be always available near the factory site. For this purpose tap water will be made available.

5.7 Plant organization and manpower

This small project has a simple organization where a Supervisor/ Technician will be responsible for the daily operation. Overall manageent of the project will be under the Manager of the farm and therefore there will be no management overheads arising.

The manpower requirement (to be treated as direct) will be as follows :-

Supervisor/Technician	1
Tapper	1 (for 10 days a month)
Operator	1
	3

Annual cost will be :-

Direct wages 1 person x 10 months	R 12,500
Supervision (considered direct) 1 x 10 months	R 17,500
	R 30,000

Manpower for filling/packaging etc does not arise as made vinegar will be transported in bulk and sold to SMB Agroindustrial Division for bottling and marketing.

5.8 Investment and financing

	R
The cost of land (does not arise)	Nil
Cost of equipment	15,000
Cost of building	63,600
Working capital (6 months)	21,400
Total cost of project	100,000

Assume financing as follows :

Equity 30%	30,000
Loan Capital 70% (10% Interest)	70,000
Total finance	100,000

5.9 Cost of production

The cost of production is estimated on an annual basis:-

Toddy :-

The commercial rate of toddy purchased from small scale tappers is R 5 per litre. However, for the purpose of the project, the cost will be based on labour cost of tapping and to this the value of the nuts will be added.

The monthly costs will be :	R
Wages for one tapper for 10 days/month	500
Value of 2.5 nuts x 20 palms @ 20 cts	10
Total	510

Therefore cost of 400 litre toddy = R 510

Cost of toddy per litre = R 1.27

Vinegar :-

The annual costs will be as follows :

Variable costs :		R
Toddy 400 l x 10 months @ 1.27		5,080
Direct labour 1 person x 10 months		12,500
Supervision (considered direct) 1 x 10 months		17,500
Electricity		1,580
Water		316
		36,976
Fixed costs :		
Building upkeep (1%)		636
Equipment upkeep (5%)		750
Management overheads		-
		1,386
Total operating costs		38,362
Depreciation of building (5%)	3,180	
Depreciation of equipment (10%)	1,500	4,680
Interest on loan capital (10% of 70,000)		7,000
Total production cost (3000 litre)		50,042

Cost of production (bulk vinegar) = R 16.68 per litre

(Note : Land considered at no cost. Working capital as Rs.21,400 for 6 months operations)

5.10 Transfer price

With the cost of production of bulk vinegar at R 16.68 per litre, the transfer price could be fixed at R 21.68 per litre after a 30% markup.

5.11 Retail price

The cost of a 750 ml bottle is R 1.05 which corresponds to R 1.40 per litre for packaging material. Assume packaging operation costs R 1 per litre, transport from SADECO to SMB costs another R 1 per litre. Total prime cost for SMB will be R 25.08 per litre. Therefore SMB will not have any difficulty in retailing the natural vinegar at R 30 per litre and yet be competitive amongst the other brands of (imported) natural vinegar which are retailed in Seychelles at about R 35 per litre.

5.12 Summary and conclusions

The coconut vinegar project as detailed in this chapter is viable and is recommended. The viability, however is because the imported natural vinegar has a 50% import duty and a high mark up by SMB.

The viability could be improved if a larger market existed in Seychelles or if an export market could be developed.

A visit of 1 week duration to a commercially operating project in Sri Lanka or elsewhere by an officer responsible for setting up the proposed project is recommended.

Tapping of toddy for the project has insignificant impact on coconut production nationally.

The total investment for the project excluding land is Rs.100,000.

LIST OF PERSONS CONTACTED

Name	Designation/Institution
Dr S. Gendron	Director General, MND
Mr R. Weber	Director, TSS of MND (Counterpart)
Ms B. Micock	Research Officer, TSS
Mr C. Gill	Director - Pests & Disease Control
Mr G. Savy	Executive Chairman, IDC
Mr R. Adelaide	Executive Chairman, SADECO
Mr J. Kwast	General Manager) SODEPAK
Mr D. Tassoulas	Operations Manager)
Mr X. Blanchard	Asst. Managing Director) Development Bank
Mr M. Port-Louis	Senior Loans Officer)
Mr Myadas	Group Product Manager, Trading Div. SMB
Mr H. Coucke	Manager, Industrial Projects,Trading Div.SMB
Mrs M. Mckelvey	Research Officer, Crafts Section of MND
Mr E. Jean-Pierre	Owner, Mark's (Pty) Ltd

POTENTIAL COCONUT PRODUCTION BY ISLAND/ATOLL

Island/atoll	Land area (ha) (As per Statistical Abstract 1986)	Coconut area estimated (ha)	Estimated Coconut pot: copra eqt at 0.75t/ha
A. Inner islands (Granitic)		25%	
1 Mahe	15,390	3,847	2,885
2 Praslin	3,756	939	704
3 La Digue	1,010	252	189
4 St Anne	219	55	41
5 Ile au Cerf	127	32	24
6 Curieuse	286	72	54
7 Felicite	268	67	50
8 Marianne	95	24	18
9 Soeur	118	29	22
10 Silhouette	1,995	499	374
11 Ile du Nord	201	50	37
12 Fregate	219	55	41
13 Other small islands	360	90	67
B. Inner islands (Coralline)		75%	
14 Ile aux Vaches	101	75	56
15 Ile Denis	143	107	80
C. Outer islands (All Coralline)			
16 Ile Platte	54	40	30
17 Coetivy	931	698	523
Amirantes group			
18 D'Arros	150	112	84
19 Desroches	394	296	222
20 Other small islands	117	88	66
21 African banks	30	22	16
22 St. Joseph's atoll	122	91	68
23 Poivre atoll	248	186	139
24 Alphonse & St Francis atolls	198	148	111
Farquhar group			
25 Providence atoll	395	296	222
26 Farquhar atoll	799	599	449
Aldabra group			
27 Aldabra atoll	15,300	-	-
28 Cosmoledo atoll	509	-	-
29 Astove	661	496	372
30 Assomption	1,171	-	-
Total Seychelles	45,459	9,265	6,944

Annex 3

EXPORT VOLUME OF COCONUT, COPRA AND COCONUT OIL

Product	Unit	1975	76	77	78	79	80	81	82	83	84	85	86	87
Coconut (freshnuts)	('000)	1157	716	1283	187	242	614	291	321	149	250	289	18	-
Copra (all grades)	tonne	2986	2829	2965	3000	3439	3200	3136	2176	2686	1767	1632	2382	2270
Coconut Oil	tonne	-	-	6.0	3.4	1.3	1.4	-	6.5	10.0	96.2	81.5	-	-

Source Information Systems Division, MND

ORIGIN OF CUP COPRA INSPECTED FOR EXPORT (tonne)

Island/atoll	1984	1985	1986	1987	1988
1 Mahe	490.1	586.3	462.2	355.1	261.8
2 Praslin	59.5	57.5	45.4	24.1	0.6
3 La Digue	141.4	167.6	163.0	153.8	132.5
4 St Anne	-	-	-	-	-
5 Ile au Cerf	-	-	-	-	-
6 Curieuse	-	-	-	-	-
7 Felicite	-	--	-	-	-
8 Marianne	10.9	10.9	25.8	24.2	17.5
9 Soeur	10.3	16.2	12.6	7.0	7.7
10 Silhouette	50.5	58.5	27.9	37.9	28.2
11 Ile du Nord	-	-	-	-	-
12 Fregate	11.7	3.5	1.7	-	-
13 Other small islands	-	-	-	-	-
14 Ile aux Vaches	-	-	-	-	-
15 Ile Denis	20.0	24.4	6.1	40.7	27.4
16 Ile Platte	8.1	19.5	25.3	15.5	18.0
17 Coetivy	93.7	54.3	72.8	69.8	54.0
18 D'Arros	100.8	138.1	139.1	146.2	135.0
19 Desroches	55.2	71.4	46.7	36.4	42.1
20 Other small islands	-	-	-	-	-
21 African banks	-	-	-	-	-
22 St. Joseph's atoll	-	-	-	-	-
23 Poivre atoll	92.6	119.4	82.2	4.8	-
24 Alphonse & St Francis atolls	-	-	-	-	-
25 Providence atoll	60.8	41.4	60.4	36.5	18.3
26 Farquhar atoll	24.7	10.6	6.0	11.6	3.3
27 Aldabra atoll	-	-	-	-	-
28 Cosmoledo atoll	-	-	-	-	-
29 Astove	4.5	12.9	8.5	6.0	11.2
30 Assomption	-	-	-	-	-
Total excl Mahe	744.7	806.5	723.5	614.3	495.7
Total Seychelles	1234.8	1392.8	1185.7	969.4	757.5

Source Director, Pests and Disease Control.

ORIGIN OF MILLING COPRA INSPECTED FOR EXPORT (tonne)

Island/atoll	1984	1985	1986	1987	1988
1 Mahe	182.5	218.5	75.6	192.3	96.3
2 Praslin	28.0	30.4	30.1	29.1	1.0
3 La Digue	41.4	65.9	46.2	37.3	28.0
4 St Anne	-	-	-	-	-
5 Ile au Cerf	-	-	-	-	-
6 Curieuse	-	-	-	-	-
7 Felicite	-	-	-	-	-
8 Marianne	29.0	26.8	26.2	10.3	9.0
9 Soeur	2.5	4.6	4.0	2.3	2.3
10 Silhouette	80.6	53.9	27.4	34.4	32.0
11 Ile du Nord	4.2	-	-	-	-
12 Fregate	8.3	3.6	-	-	-
13 Other small islands	-	-	-	-	-
14 Ile aux Vaches	-	-	-	-	-
15 Ile Denis	16.5	24.4	22.0	8.4	3.8
16 Ile Platte	15.8	20.5	4.9	22.6	15.1
17 Coetivy	63.2	24.9	30.8	55.9	72.0
18 D'Arros	97.4	46.6	89.9	89.0	39.9
19 Desroches	47.9	86.0	68.4	71.5	78.4
20 Other small islands	-	-	-	-	-
21 African banks	-	-	-	-	-
22 St. Joseph's atoll	-	-	-	-	-
23 Poivre atoll	34.9	57.3	42.4	2.8	-
24 Alphonse & St Francis atolls	-	-	-	-	-
25 Providence atoll	43.8	55.8	89.8	51.6	27.9
26 Farquhar atoll	46.0	13.1	10.5	6.3	5.7
27 Aldabra atoll	-	-	-	-	-
28 Cosmoledo atoll	-	-	-	-	-
29 Astove	10.1	7.2	7.3	4.0	7.1
30 Assomption	-	-	-	-	-
Total excl Mahe	570.0	521.4	500.0	425.4	322.1
Total Seychelles	752.5	739.9	575.6	617.7	388.4

Source Director, Pests and Disease Control.

ORIGIN OF ALL COPRA INSPECTED FOR EXPORT (tonne)

Island/atoll	Cup copra tonne/yr 1984-88 Average	Mille Copra tonne/yr 1984-88 Average	All copra tonne/yr 1984-88 Average
1 Mahe	431.1	153.0	584.1
2 Prasiin	37.4	23.7	61.1
3 La Digue	151.7	43.7	205.4
4 St Anne	-	-	-
5 Ile au Cerf	-	-	-
6 Curieuse	-	-	-
7 Felicite	-	-	-
8 Marianne	17.9	20.3	38.2
9 Soeur	10.8	3.1	13.9
10 Silhouette	40.6	45.7	96.3
11 Ile du Nord	-	0.8	0.8
12 Fregate	3.4	2.4	5.8
13 Other small islands	-	-	-
14 Ile aux Vaches	-	-	-
15 Ile Denis	23.7	15.0	38.7
16 Ile Platte	17.3	15.8	33.1
17 Coetivy	68.9	49.4	118.3
18 D'Arros	131.8	72.6	203.4
19 Desroches	50.4	70.4	120.8
20 Other small islands	-	-	-
21 African banks	-	-	-
22 St. Joseph's atoll	-	-	-
23 Poivre atoll	59.8	27.5	87.3
24 Alphonse & St Francis atolls	-	-	-
25 Providence atoll	43.4	53.8	97.2
26 Farquhar atoll	11.2	16.3	27.5
27 Aldabra atoll	-	-	-
28 Cosmoledo atoll	-	-	-
29 Astove	8.6	7.1	15.7
30 Assomption	-	-	-
Total excl Mahe	676.9	467.8	1144.7
Total Seychelles	1108.0	614.8	1722.8

Source Calculated from Annexes 4 and 5

Annex 7

PATTERN OF COCONUT UTILIZATION BY ISLAND/ATOLL (tonne)

	Island/atoll	Copra potential (Annex 2)	Copra production (Annex 6)	Coconut utilization %
1	Mahe	2885	584.1	20
2	Praslin	704	61.1	9
3	La Digue	189	205.4	108
4	St Anne	41	-	-
5	Ile au Cerf	24	-	-
6	Curieuse	54	-	-
7	Felicite	50	-	-
8	Marianne	18	38.2	21
9	Soeur	22	13.9	63
10	Silhouette	374	96.3	26
11	Ile du Nord	37	0.8	2
12	Fregate	41	5.8	14
13	Other small islands	67	-	-
14	Ile aux Vaches	56	-	-
15	Ile Denis	80	38.7	48
16	Ile Platte	30	33.1	110
17	Coetivy	523	118.3	23
18	D'Arros	84	203.4	242
19	Desroches	222	120.8	54
20	Other small islands	66	-	-
21	African banks	16	-	-
22	St. Joseph's atoll	68	-	-
23	Poivre atoll	139	87.3	63
24	Alphonse & St Francis atolls	111	-	-
25	Providence atoll	222	97.2	44
26	Farquhar atoll	449	27.5	6
27	Aldabra atoll	-	-	-
28	Cosmoledo atoll	-	-	-
29	Astove	372	15.7	4
30	Assomption	-	-	-
	Total excl Mahe	4059	1144.7	28
	Total Seychelles	6944	1722.8	25

Annex 8

COPRA DRYER (CALORIFER) OF SEYCHELLES

Annex 9

EXPORT VALUE OF COCONUT, COPRA AND COCONUT OIL

		1977	78	79	80	81	82	83	84	85	86	87
Coconuts	R.000	1,146	224	284	593	283	299	147	223	298	20	NIL
	R/nut	0.89	1.20	1.17	0.97	0.97	0.93	0.99	0.89	1.03	1.11	-
Copra	R.000	14,503	16,157	19,924	16,979	17,008	8,850	11,346	8,208	7,557	3,811	3,214
	R/kg	4.89	5.39	5.79	5.31	5.42	4.07	4.22	4.64	4.63	1.60	0.70
	R/nut	0.70	0.80	0.83	0.77	0.77	0.58	0.60	0.66	0.66	0.23	0.10
Coconut Oil												
	R.000	24	11	6	5	Nil	13	100	720	220	Nil	Nil
	R/kg	4.00	3.24	4.61	3.57	-	2.00	10.00	7.48	2.70	-	-

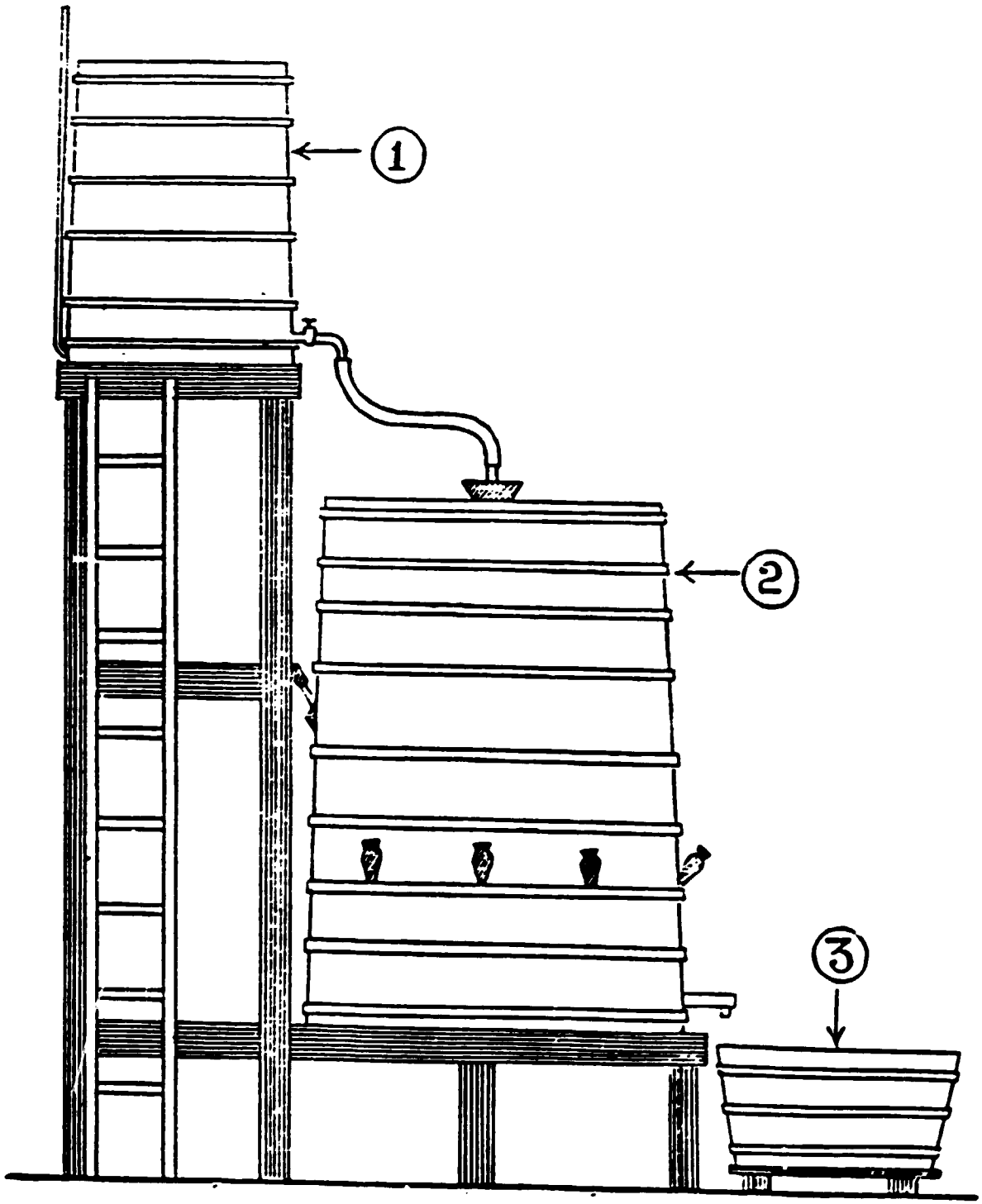
Source : Information Systems Division, MND

VINEGAR BRANDS MARKETED IN SEYCHELLES

	Brand, type and colour	Pack Size (ml)	Retail Price (R)	Unit retail price R/litre
1	CIRIO (Italy) wine-white	500	16.30	32.60
2	CIRIO (Italy) winebrown	500	13.50	27.00
3	DUFRAIS (Switzerland) wine-Tarrangon	500	17.60	35.20
4	DUFRAIS (Switzerland) wine-red	500	17.60	35.20
5	STIMULA (France) wine with Strawberry flavour	750	23.60	31.47
6	SAFARI (S Africa) Apple Cider	375	5.40	14.40
7	EUZOL (S Africa) Artificial-white	750	4.90	6.53
8	EUZOL (S Africa) Artificial-Brown	750	4.90	6.53

Source Data collected by visiting SMB Supermarket in Victoria.

COMMERCIAL SCALE VINEGAR GENERATOR

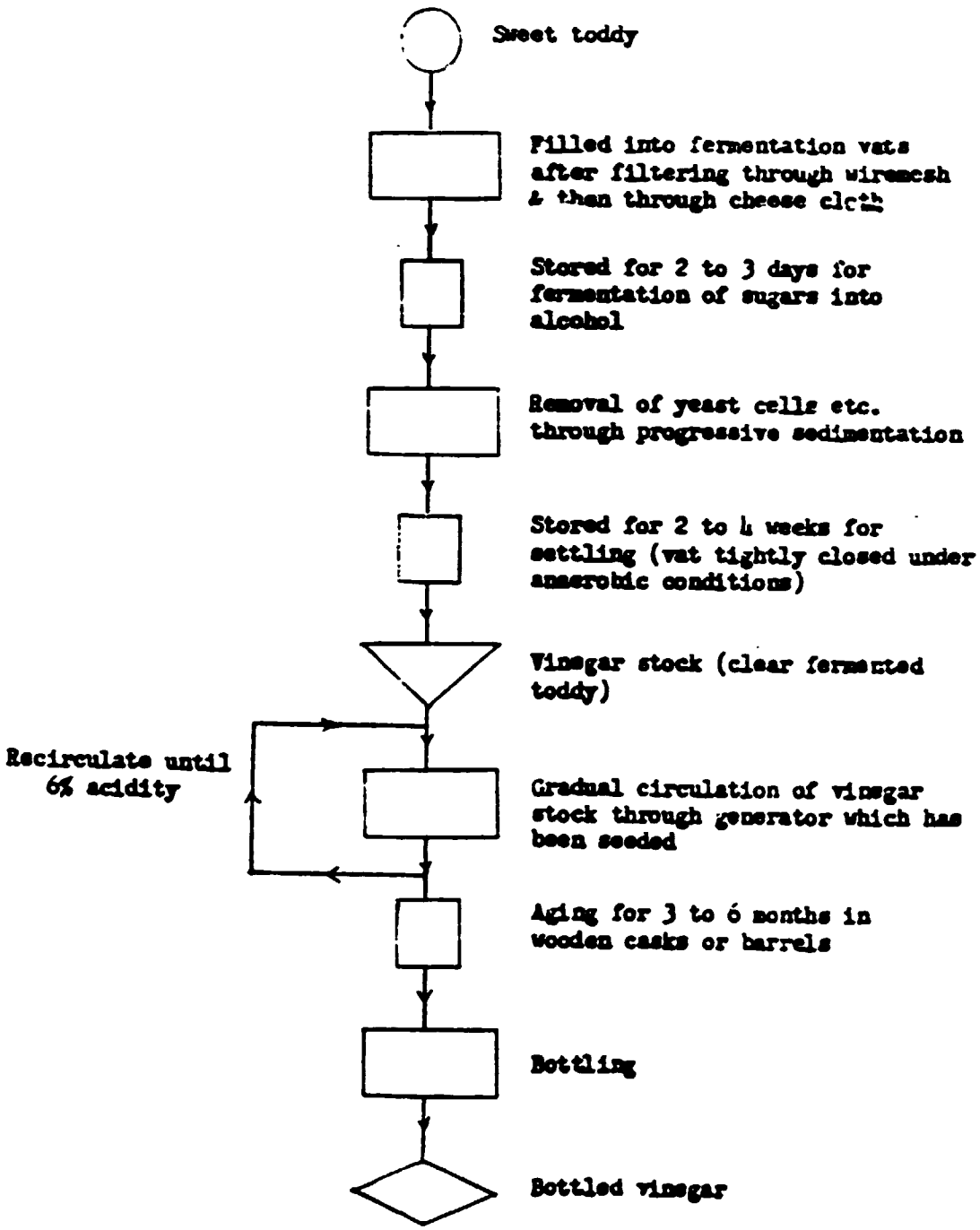


(scale half inch to a foot).

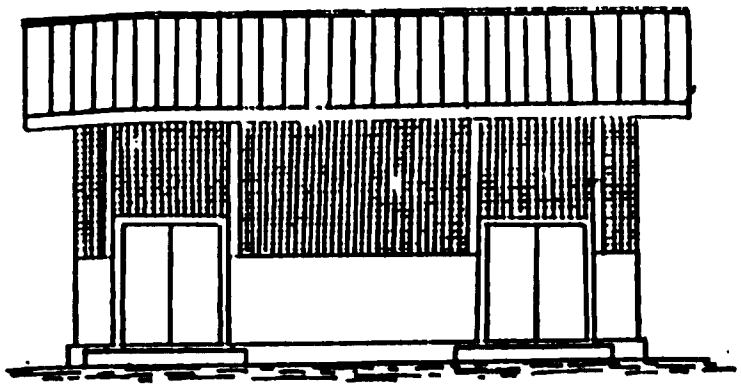
1. Feed Trough 2. Acetifier 3. Receiving trough

Annex 12

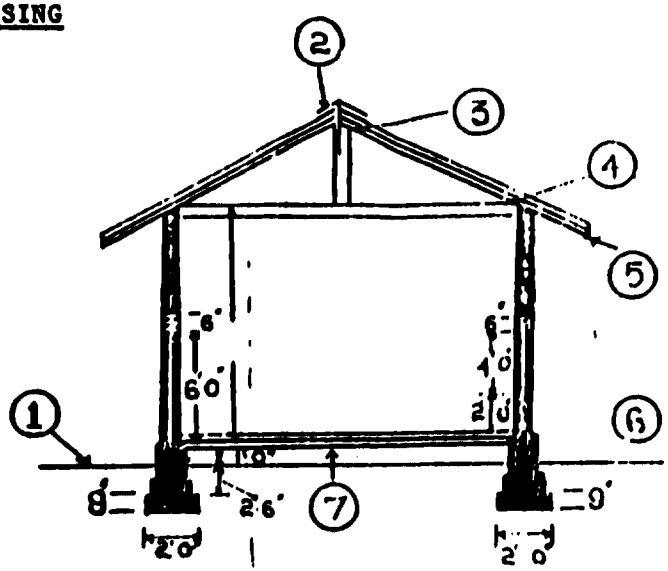
PROCESS FLOW DIAGRAM



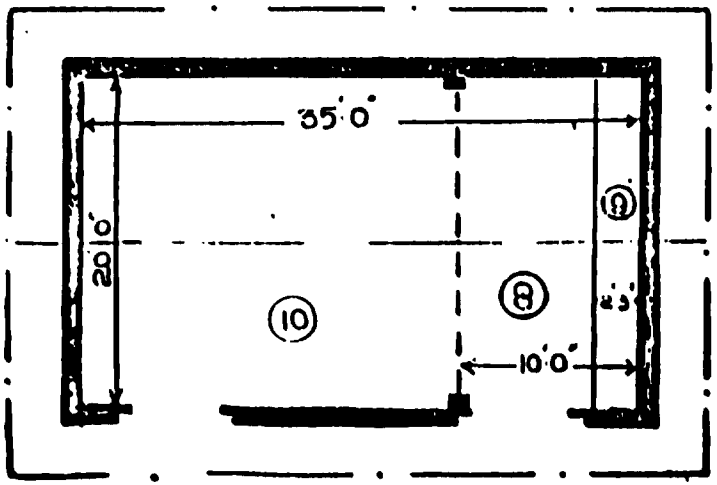
FACTORY HOUSING



FRONT ELEVATION

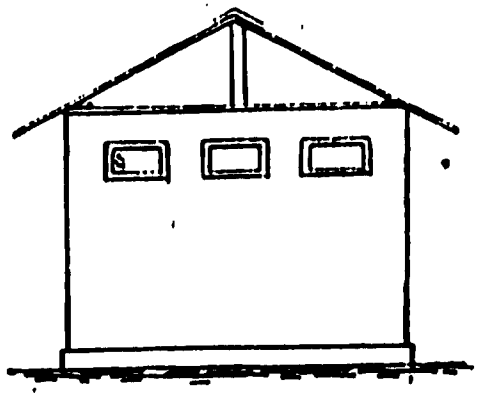


SECTION A B.



PLAN

(Scale 1 inch to 8 feet)



SIDE ELEVATION

1. Ground Level
2. Ridge Tile
3. 6" x 2" Ridge Plate
4. 4" x 2" Wall Plate
5. 8" x 3/4" Valanced Boar
6. D.P.C.
7. Filling
8. Cement Floor
9. Work Bench
10. Consolidated Rammed Floor