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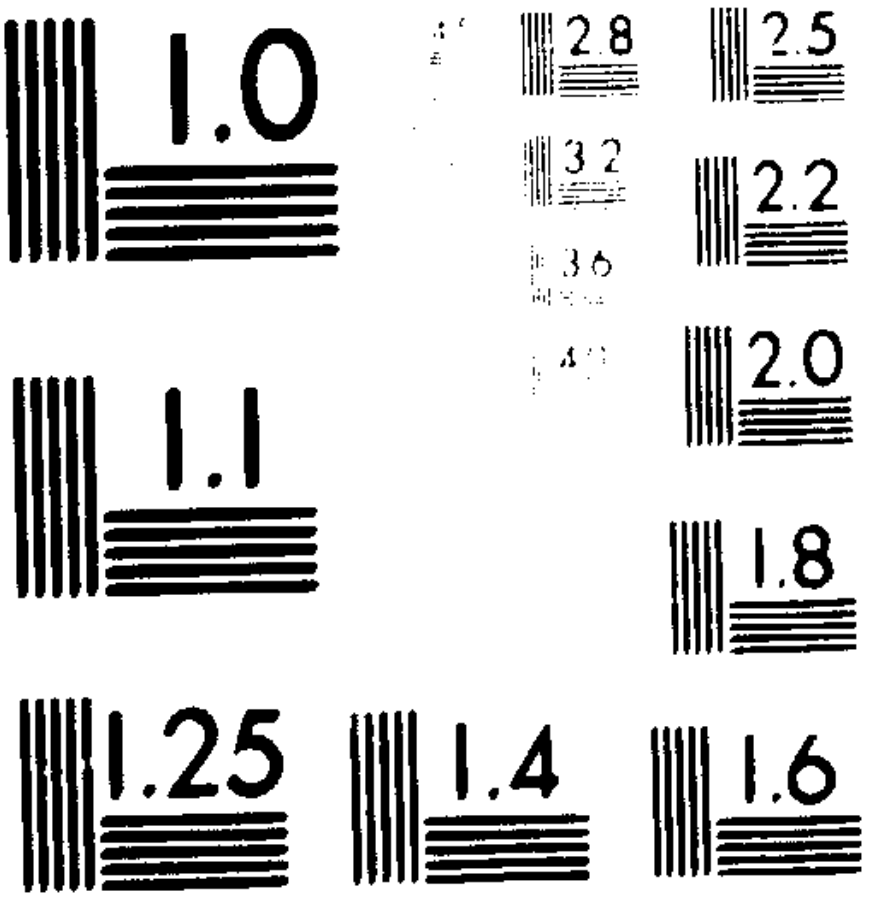
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org



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2 June 1980
English

# ESTABLISHMENT OF A FRUIT AND VEGETABLE PROCESSING PLANT

SI/SEY/80/801

SEYCHELLES

Terminal report*

Prepared for the Government of the Seychelles
by the United Nations Industrial Development Organization,
executing agency for the United Nations Development Programme

Based on the work of Roberto H. Moretti, fruit and vegetable processing expert

United Nations Industrial Development Organization

Vienna

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## 1. Introduction

After Mr. Zachmann's report "Industrial Survey" SI/SEY/78/802 terminated on 21 June 1979, it was decided by the Seychelles Government to go more deeply in the subject "Fruit and Vegetable Processing".

This chapter was studied by Mr. Zachmann in his report from page 96 to 109 and shows the prospective of installing a plant for processing 1 ton per hour, using their own raw material as per table 15 on page 97. The Seychelles will have by the year 1981 an available amount of 500 tons of raw material to be processed, and by the year 1985, 1,875 tons.

The Seychelles have been importing food for a long time and in the last three years, this importation has been increasing significantly, due mainly to tourism. In 1979, the total imports of fresh and processed fruit and vegetables reached an amount of Rupees Seychelles (RS) 11,470,000 (or US$ 1.7 million) with an average cost per kilo of RS 8-10. Only processed fruits and vegetables are responsible for RS 6,300,000 (about US$ 1 million) which represents more than 50 per cent of imported fruit and vegetables.

The Seychelles have a tropical climate and grow several types of tropical fruit and vegetables, which are becoming more and more important after the installation of the State Farms, run by the Government as a private company. These farms will be producing tropical fruit and vegetables starting next year (1981). Besides State Farms, the Seychelles have a lot of small farmers and back-yard plantations which can contribute with significant amounts of raw material for a fruit and vegetable processing plant.

The installation of a plant for this purpose would use all this surplus raw material production and also would substitute for a significant part of the imports. Besides that, the tropical products would be very much appreciated by European tourists.

With reference to the Seychelles Trade Report 1977, Section 0 - Food and Live Animals, total Seychelles importation amounts to RS 67,225,000 - CIF value.

## Table 1 and Table 1A Imports by Products

### Section 0 Food and Live Animals

| (a) 1977 | | R.S.$ | R.S./Kg. |
|---|---|---|---|
| Meat and meat preparations | | 7,882,000 | 14.00 |
| Milk - evaporated or condensed | | 5,548,000 | 2.39 |
| Milk - dried or fresh | | 1,936,000 | 5.59 |
| Other dairy products | | 2,097,000 | |
| Rice | | 9,642,000 | 0.67 |
| Flour | | 2,553,000 | 0.68 |
| Malt | | 2,065,000 | 1.22 |
| Fruit and vegetables | | 11,470,000 | 8 - 15 |
| Sugar | | 5,300,000 | 1.00 |
| Animal feedstuffs | | 4,922,000 | 0.65 |
| Margarine, ghee and lard | | 2,561,000 | 4.09 |
| Other food and live animals | | 11,249,000 | |
| Total | RS$ | 67,225,000 | |

| (b) 1978 | | R.S.$ | Quantities (tons) | RS/Kg. |
|---|---|---|---|---|
| Meat and meat preparations | | 8,232,000 | | |
| Milk evaporated or condensed | | 5,674,000 | 934 | 6.07 |
| Milk - dried or fresh | | 3,239,000 | 518 | 6.25 |
| Other dairy products | | 2,568,000 | 162 | 15.85 |
| Rice | | 13,051,000 | 6,299 | 2.07 |
| Flour | | 3,999,000 | 1,651 | 2.42 |
| Malt | | 499,000 | 251 | 1.98 |
| Fruit and vegetables | | 11,406,000 | 1,966 | 5.80 |
| Sugar | | 4,779,000 | 2,077 | 2.30 |
| Animal feedstuffs | | 6,280,000 | 3,452 | 1.81 |
| Margarine, ghee and lard | | 2,850,000 | 289 | 9.86 |
| Other food and live animals | | 14,775,000 | - | - |
| Total | RS$ | 77,352,000 | | |
| Non-alcoholic beverages | | 743,000 | 197 | 3.77 |
| Grand Total | | 78,095,000 | | |

Source: Trade Report 1978 and 1979

From this total (RS 67,225,000 and 78,095,000) importation value, Division 05 on the same Trade reports - 1977 and 1978, show the fruit and vegetables sector, which indicates an importation value of RS 6,285,000 in 1977 (see table 2 and 2A).

Most of these products are European style and produced with temperate climate raw materials. The country could produce similar processed foods by using their own resources and offering the tourists different products which are particular for them. This would attract more tourists and could result in more satisfaction for them, in addition, saving foreign currency for the Islands.

Table 2. Fruit and Vegetables Imports

Division 05:

| | Quantity Tons | Value RS$ |
|---|---|---|
| Vegetables preserved or prepared | 150 | 1,200,000 |
| Jams, marmalades, fruit jellies, purees pastes | 80 | 543,000 |
| Fruit squash | 230 | 845,000 |
| Fruit juices (others) | 233 | 1,300,000 |
| Fruit saturated with sugar | | 92,000 |
| Dried fruit | 6 | 93,000 |
| Fruit and nuts, prepared or preserved | 72 | 662,000 |
| Vegetables, frozen or temporary preservative | 189 | 1,550,000 |
| | | RS 6,285,000 |

Table 2A Imports by commodities - 1978

| | Quantity KG | Value RS$ |
|---|---|---|
| Dried fruit (figs, raisins, etc.) | 6,522 | 87,704 |
| Fruit, fruit peel, preserved by sugar, crystallized | - | 98,198 |
| Jams, marmalade, jellies fruit purees and parts | 99,753 | 599,769 |
| Fruit squashes | 278,030 | 971,255 |
| Other fruit juices and vegetable juices | 233,351 | 1,413,320 |
| Fruit and nuts, prepared or preserved | 102,987 | 830,040 |
| Tomatoes, fresh | 8,279 | 94,985 |
| Onions, fresh | 580,347 | 1,104,011 |
| Garlic, fresh | 36,020 | 330,046 |
| Vegetables preserved (tomato puree) | 190,284 | 1,372,504 |
| Sugar | 921,958 | 1,887,244 |
| Sugar confectionary and other sugar preparations (except chocolate) | 143,103 | 1,383,203 |
| Chocolate preparation | 95,515 | 1,323,686 |
| Feedstuffs for animals | 2,552,821 | 4,382,022 |
| Margarine | 264,424 | 2,661,473 |
| Soups | - | 225,464 |
| Vinegar | 23,094 | 298,487 |

Source: Trade Report - 1977 and 1978 (February 1979)

2. Concept of the plant to process fruit and vegetables

If the size of the country and its population is taken into account, one should be very careful in identifying the size of a fruit and vegetable processing plant.

If Table 3 and 4 are studied, one can realize that there is not too much raw material to be processed, since total availability is around 600 tons per year. According to prospectives made by the Government, in the year 1985, there will be more raw material available, since the State Farms will start harvesting their own products.

The distribution of raw materials through the months of the year are shown in Table 4, which presents a good distribution and also the possibility of reprocessing imported raw material, with an added-value created by the new processing plant to be established.

Table 3

| Produce | Tons Produce Not Sold | Tons Additional production |
|---|---|---|
| Tomatoes | 20 | - |
| Cucumbers | 20 | - |
| Beans | 10 | - |
| Cabbage | 10 | - |
| Pumpkin | 20 | - |
| Sweet potatoes | 30 | -- |
| Cassava | 0 | 60 |
| Other root vegetables | 10 | 10 |
| Other vegetables | 30 | 10 |
| Bananas | 70 | 90 |
| Pawpaws | 20 | - |
| Mangoes | 10 | 130 |
| Pineapples | 30 | - |
| Limes/lemons/oranges | 10 | 10 |
| Other fruit | 10 | 20 |
| Total | 300 | 330 |

Source: Page 24 - 1978 Agriculture Survey March/1980

TABLE 4

Fruits and Vegetables availability during the year

| | Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Papaya | | | | | | | | | | | | |
| Mangoes | | | | | | | | | | | | |
| Banana | | | | | | | | | | | | |
| Pineapple | | | | | | | | | | | | |
| Jackfruit | | | | | | | | | | | | |
| Pumpkin | | | | | | | | | | | | |
| Sweet potatoes | | | | | | | | | | | | |
| Limes, lemons, oranges | | | | | | | | | | | | |
| Tomatoes | | | | | | | | | | | | |
| Onions | | | | | | | | | | | | |
| Cassava or yuca | | | | | | | | | | | | |
| Soy beans | | | | | | | | | | | | |
| Olives | | | | | | | | | | | | |
| Green peas | | | | | | | | | | | | |
| Sherries | | | | | | | | | | | | |
| Coconut | | | | | | | | | | | | |
| Guava | | | | | | | | | | | | |
| Additives and common ingredients | | | | | | | | | | | | |
| Golden apple | | | | | | | | | | | | |
| Bigarade | | | | | | | | | | | | |
| Local plum | | | | | | | | | | | | |
| Egg plant | | | | | | | | | | | | |

The size of the plant should be very small and versatile. This concept is very important for the success of the new investment.

Equipment should work economically with diversified raw materials and with small quantities per day.

Table 5 shows the variety of final products which could be processed and the raw materials which could be used.

Most of the final products should be in liquid form, since raw materials are not uniform and by processing them in this form, homogeneity could be solved.

The best part of the fruits and vegetables could be selected to be processed into syrup form.

Some raw materials could be imported in big containers and reprocessed in this plant in order to keep permanent labour and increase total production, besides adding value to these cheap imported raw materials, which are available all year around in different countries.

Containers to be used should be mainly bottles, which can be re-used several times, lowering the cost and avoiding pollution. The country is very small and transport of empty bottles would not increase significantly the production cost. Besides bottles, also"Doypack"plastic containers should be tried.

When cans must be used, only No. 2 and No. 2.1/2 should be chosen in order to avoid cost increase due to changes in the sealing machine, size of carton boxes, size of labels, etc.

Table 5 : Products which can be processed

(i) Fruit juices: orange, lime, pineapple, tomato

(ii) Fruit nectares: mango,banana, grape, papaya

(iii) Soy milk: Soybeans - vegetable protein (meat extender) residue

(iv) Fruit pulp: bananas, mango, guava

(v) Vegetable soups: onions, tomatoes, potatoes, manihoc, chicken meat, chicken liver, heart, maize soup plus seasoning

(vi) Coconut milk: coconut

(vii) Rehydrated green peas (repacking)

(viii)Olives (repacking)

Table 5 (cont'd)

(ix) Sherries (repacking)

(x) Fruit jams and jellies: banana, mango, guava, orange, pumpkin, sweet potatoes

(xi) Fruit in syrup: pumpkin, sweet potatoes, mango, guava, orange peel, pineapple, papaya green

(xii) Dried plums

3. Location of the Plant

In order to avoid atmosphere pollution and sewage problems, the plant should be located in the Barbarons Estate, close to the Barbarons River. This would allow the food plant to have water, electricity, roads, and other available infrastructures. This location is far from the tourists' beaches, hotels and also out of transit congestion. The road is good, electricity could be easily conveyed to it and water can be captured from the Barbarons River, which is clean and permanent throughout the year.

Another possibility would be to install the plant right next to the dairy plant in order to take advantage of all their infrastures (road, building, water, electricity, boiler, cooling equipment, stainless-steel vats, closing machines, telephone, telex, pick-up, car, already developed hand labour, etc.). We favour this second alternative.

4. Equipment to be selected

The following list of equipment was based on the smallest available machinery and also the most versatile ones. They are available in Brazil, Italy, India, Argentina and some in the U.S.A. They are not expensive, and easy to be maintained. Spare parts are always available and there is no automation in order to keep them simple and easy to operate.

Manually-operated equipment, creates more hand labour and also a kind of school for a new profession non-existant in the Islands.

Table 6 shows the list of equipment which with their approximate value, and should not be taken as definite, since an international bid should be made in order to ascertain the exact figures and also the time for delivery.

Table 6

| Equipment | Value US$ |
|---|---|
| Fruit and vegetable washer | 2,000 |
| Sanitary sorting table with rubber belt conveyor | 2,000 |
| Sanitary peeling table with chemical peeler | 4,000 |
| Fruit and vegetable blancher (Thermobreak) | 4,000 |
| Compact equipment for fruit, vegetables and animal extract production | 60,000 |
| Sealing machine and corking machine | 1,500 |
| Cooling water bath | 500 |
| Autoclave, manual with 300 l. capacity | 2,000 |
| Exhausting box (tunnel) | 1,000 |
| drying chamber - (trays) tunnel type | 6,000 |
| Fumigation chamber | 500 |
| Tanks for syrup and juices - 500 l. each | 2,000 |
| Water bath (hot) | 500 |
| Centrifugal pump | 1,000 |
| 1 Boiler - 500 kg. steam per hour | 5,000 |
| Screw press for coconut - small | 5,000 |
| Tilt open vat evaporator with agitator - 200 lt. | 4,000 |
| Laboratory equipment (see Annex 1) | 5,000 |
| | US$ 106,000 |
| Piping, electricity, steam, water installation. 25% of investment | 25,000 |
| Construction (includes: water reservoir, gardens, roads, fence, electricity) | 130,000 |
| Grand Total | US$ 261,000 |

5. Characteristics of the equipment to be purchased

Fruit washer: Universal-type fruit washer with inclined conveyor to remove fruit from the water bath, passing under water showers.

Sanitary sorting or selection table: 5 Metres long horizontal rubber conveyor belt made of sanitary rubber 0.70m. wide with stainless steel tables on both sides, having the return available to transport waste and divisional sectors on the centre.

Sanitary peeling table: 5 Metres long horizontal rubber conveyor belt made of sanitary rubber 0.70m. wide with stainless steel tables on both sides, having divisional sectors on its centre and also available return to transport peels and seeds.

Chemical peeler: Made of stainless steel, divided in two sectors each one having a tilt basket made of perforated stainless steel plate, which submerges in the hot Na OH solution. The bath must have a steam heating coil, which indirectly heats the solution in one of the sectors.

Thermobreak: Screw conveyor made of stainless steel with double wall steam-heated, divided in two sections of 2 m. long each. One section feeds the other, next to it, by gravity. Supplied with condensed water remover under each end of each section. Transport of raw material is made by screw conveyor moved by a motor through a reduction box. The equipment must transport and heat 500 kg. fruit and/or vegetables per hour.

Compact equipment for fruit and vegetable extract production: Constructed of stainless steel in the parts in contact with product. Supplied with disintegrator "Reitz" type, which can disintegrate vegetables or animal products inside liquid bath, having 2HP motor and three sets of perforated screen (1, 2. 5mm). A basket centrifuge which can mix the disintegrated product and also remove the liquid from the dispersed phase (insolubles).

Having three sets of nylon screens, which filters the liquid on centrifuging it.

Centrifugal stainless steel pump with 300 l/hr. capacity, sanitary. Two tanks with independent agitators, 45 l. capacity each, with centrifugal pump which can feed liquid from above tanks to next step, continuously. These two tanks have two independent ball valves. Sterilizer-cooler, built inside an electrical boiler of 18,000 w - 220 v. - 3 phases. The liquid circulates through a stainless steel coil which passes inside the boiler chamber and then goes to a retention tube and cooler system which is also a coil with cooling water outside.

Part of cooling water can be recovered as hot water to be used for soy milk production. The equipment is also supplied with a water heater tank electrically heated by resistances of 9,000 w - 220 v. - 3 phases - with 100 litres capacity.

Sealing machine: Electrical, semi-automatic, for grafting No. 2.1/2 and No. 2 cans, cylindrical. Capacity to seal 600 - 800 cans per hour. Type "Dixie" table sealing machine.

Crowning machines: Hand-operated, bench type, to close 250 bottles/hr. each.

Water-coolers: Water bath type with water entering the bottom of a rectangular tank, 500 litres capacity and excess water leaving the top of opposite side. Supplied with steel crates to hold 20 - 30 cans each which fits exactly the inside of water bath tanks.

Autoclave: 300 litres capacity, to sterilize canned food at 121°C. Vertical, with lid on the top, closes by eight clamps, having inside a crate of perforated steel plate on steel frame, which holds 100 - 2.1/2 cans at a time.
Supplied with pipes and valves for steam, cooling water, compressed air. Also supplied with thermometers, pressure gauge, pressure relief valve, air removal valve, air compressor and manual lifter for the crate.

Exhausting tunnel: For one row of cans, transported by steel chain, tunnel must be 5 m. long and chain moved by electrical motor 1 HP, reduction box and pulleys to allow three velocities in order to have 3, 6, 12 minutes retention time. Supplied with chimneys at both ends and condensate outlet, steam pipe and valve.

Fumigation chamber: Holds one car of the dryer at a time. Hermetically closed. 316 stainless steel construction. To use $SO_2$ or ethyl bromate as fumigants. Supplied with burette for liquid $SO_2$ or ethyl bromate. 60 x 60 x 80 cm (wide x deep x tall).

Drying chamber: Electrically heated, having centrifugal ventillator with return of part of the air. Tunnel type, supplied with seven cans which hold eight trays each. Five of the cars work in the drying chamber and two of them are for feeding new raw material and fumigation with $SO_2$. Trays must be 50 x 50 cm. aluminium perforated plate.
Must have two doors at both ends for admitting and removal of cars.

Tanks: Two stainless steel tanks with 500 litres capacity each having a ball valve in the bottom and supported by three legs. Sanitary construction, polished.

Centrifugal pump: 304 stainless steel, sanitary. With 3HP motor 220v - 3 phases. To pump 500 - 1,000 litres/hour at a pressure of 3 kg./$cm^2$.

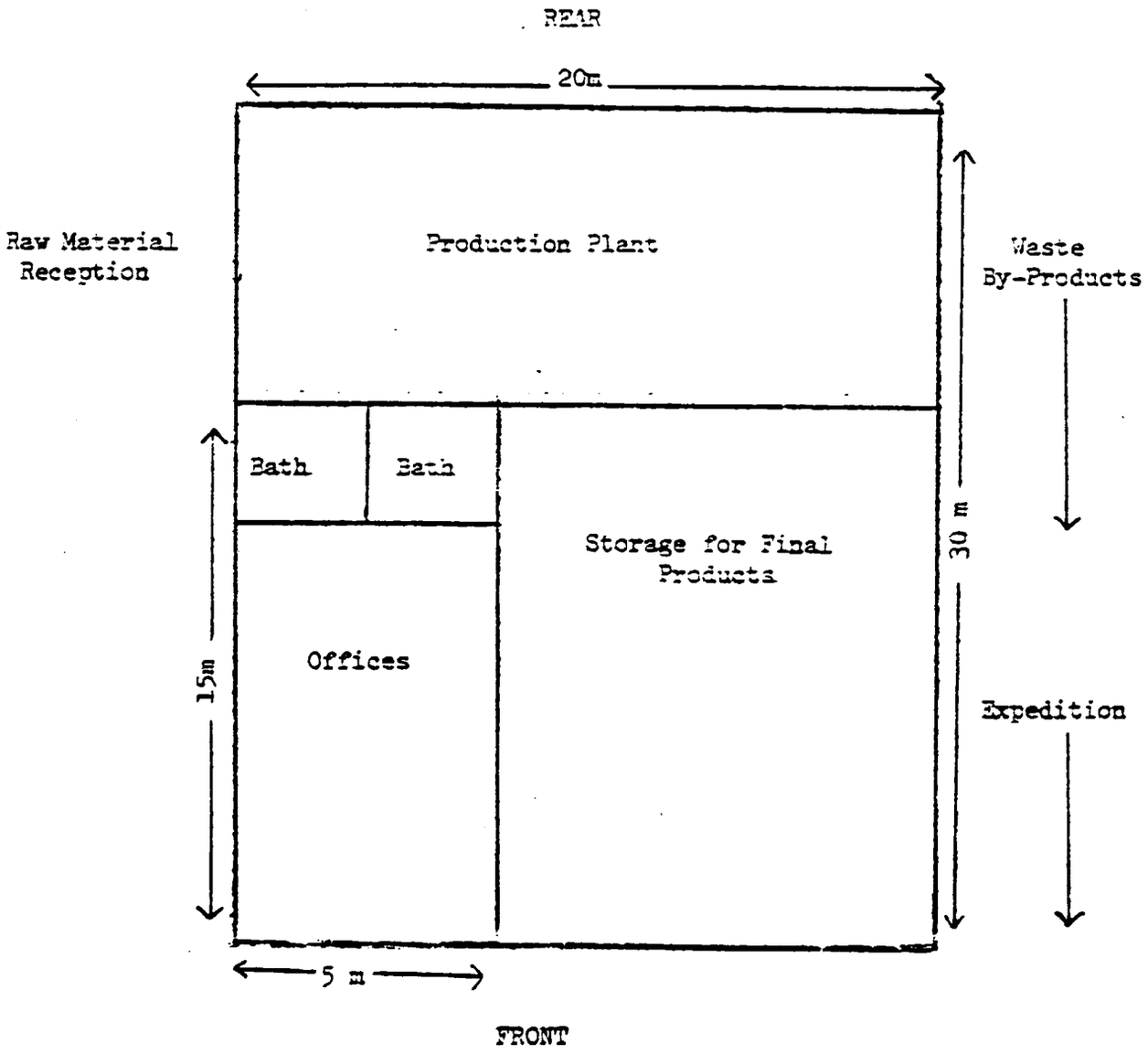
Boiler: To produce 500 kg. steam per hour at 8 $kg/cm^2$ pressure. Heating pipes must work submerged in water and must be compact and automatically operated, supplied with feeding pump for oil and heating element to work with viscous oil (BPF type).

Screw press: Conical construction, expeller type. Stainless steel construction, reinforced with stainless steel frame. Suited to press food materials, grinded coconut meat, soybean residue, etc., perforated plate with 1mm. holes.

Tilt open vat evaporator with agitator: 200 Litre capacity, made of stainless steel, with double wall to be steam heated. Must have agitator rotating at 40 rpm almost scraping inside wall.
Must tilt to discharge concentrated material. Must evaporate 50 litres water per hour with a pressure of 1.5 $kg/cm^2$ in the jacket.

6. Plant Layout

Fruit and Vegetable Processing Plant



7. Production Plan

(a) 50 per cent juices, nectars, pulp, jams, jellies.

(b) 50 per cent fruit in syrup, processed vegetables, repacked or reprocessed imported products.

(c) 10 per cent marmalades, soups, coconut milk, soy milk.

Quantities - 300 tons/year (a); 240 tons/year (b) and 60 tons/year (c) giving a total of 600 tons/year production.

300 tons/year ÷ 200 days = 1.5 tons/day (a)
240 tons/year ÷ 250 days = 0.96 tons/day (b)
60 tons/year ÷ 250 days = 0.24 tons/day (c)

8. Financial Aspects

8.1 Production sales value

600,000 kilos x 9 R.S. - R.S. 5,400,000

8.2 Production costs - Industrial

| | R.S. |
|---|---|
| Hand labour (10) | 84,000 |
| Electricity 50-70 kwh x 8 hours per day | 30,000 |
| Packaging | 400,000 |
| Raw materials (600 tons) | 2,000,000 |
| Overheads | 150,000 |
| Steam | 12,000 |
| Water | 3,000 |
| Exterior maintenance | 20,000 |
| Direct wages | 40,000 |
| Indirect wages | 50,000 |
| Transport | 15,000 |
| R.S. | 2,804,000 |

8.3 Investment

| | Rupees | Depreciation |
|---|---|---|
| Land | 15,000 | 300 |
| Factory and offices | 1,000,000 | 50,000 |
| Equipment and installation | 1,200,000 | 50,000 |
| Transport and taxes | 120,000 | 12,000 |
| Variables | 240,000 | 24,000 |
| Final fitting and start-up | 130,000 | 40,000 |
| | 2,705,000 | 176,300 |

8.4 Interest

| | Rupees |
|---|---|
| Long-term - loan 2,705 x 0.8 = | 216,400 |
| Short-term - loan 500 x 1.0 = | 50,000 |
| | 266,400 |

8.5 Estimated profit and loss

| | |
|---|---|
| Investment cost (depreciation) | 176,300 |
| Running costs | 2,804,000 |
| Interest | 266,400 |
| | 3,246,700 |

8.6 Sales Revenue

| | |
|---|---|
| Domestic market | 5,400,000 |
| Benefit | 2,153,300 |

ANNEX I

Quality Control Laboratory

| Each | |
|---|---|
| 1 | Incubation chamber - 28°-35°C (0.50 x 0.50 x 0.50) |
| 1 | Hand refractometer - 0-25° Brix |
| 1 | Hand refractometer - 45-85° Brix |
| 1 | PH meter - portable - 0-14 |
| 6 | Burettes - 50 ml. - 0.05 ml. precision |
| 6 | Burettes - 25 ml. - 0.05 ml. precision |
| 12 | Enlenmyrs - 250 ml. 125 ml. |
| 24 | Beckers - 250 ml., 100 ml, 50 ml. |
| 12 | Volumetric flasks - 1.01, 100 ml. |
| 12 | Pipetes - volumetric - 10 ml. - 1 ml - 50 ml. |
| 12 | Pipetes - bacteriological - 1 ml, 10 ml. |
| 3 | Dryers - 10 litres with silica-gel |
| 1 | Laboratory oven - 50-150°C with ventilator |
| 1 | Water bath - 100°C with thermostat and 6 places |
| 1 | Analytical balance - 150 g. + 0.001g. |
| 1 | Bench scale - 1,200 g + 0.1g. |

Total cost US$ 5,000.00

ANNEX 2

Programme for Mr. R. Moretti, UNIDO Food Industry Specialist

(21 - 28 April 1980)

1. Purpose of Visit

Mr. Moretti is here to advise the Government on the setting up of fruit and vegetable processing plant. During his mission he will look closely at the feasibility of installing this plant; the earlier project prepared by the UNIDO Industrial Survey Team last year is considered to be too expensive and too large for the Seychelles. Mr. Moretti will hopefully come up with a smaller and less costly plant.

2. Programme

Monday 21st April 1980

Arrived at 18.05h - received by the Seychelles counterpart, Mr. E. Faure.

Tuesday 22nd April 1980

09.00 Meeting with Mr. Ryan, Small Industries Expert. Department of Finance.

11.00 Meeting with Mrs. MacGaw, Senior Assistant Secretary, Department of Economic Development Planning and Housing, Unity House.

14.00 Meeting with Mr. S. Savy, Principal Secretary, Ministry of Agriculture and Land Use, Botanical Gardens.

Wednesday 23rd April 1980

14.00 Meeting with Mr. Fockheng at Victoria Hospital.

Thursday 24th April 1980

08.30 Meeting with Mr. Workman, General Manager of Seychelles National Investment Corporation and Mr. Whitmarsh-Knight, Investment House.

10.00 Meeting with Mr. Robert, Manager of Seychelles Farmer's Marketing Cooporation.

12.00 Visit to Dairy plant - Mr. Kersley St. Ange, Manager and Mr. Claude Figeran and wife.

14.00 Visit to various state farms.

ANNEX 2 (Cont'd)

Friday 25th April 1980

09.00 Claude Figeron. Tel 745.60.57 40bd, du General Leclerc 92,200 Neuilly sur Seine.

15.30 Meeting with Mr. Robert Grandcourt, Principal Secretary, Department of Economic Development Planning and Housing.

Monday 28th April 1980

Departure at 19.00 h by BA 062.

ANNEX 3

28/04/80.

REPORT ON LAITERIE DES ILES

The "Laiterie" was visited twice, once with Mr. Pigerou and the second time with Mr. Workmann. This dairy industry was based in a good concept, which means the size is well suited for the country's consumption. It is very small and the equipment is completely manually operated or semi-automatic, with exception of Cold Room, Water Heeters, Hot Water System of tank jacket, Cold Tank.

They are producing :

1. Reconstituted cow's milk
2. Cottage cheese
3. Fresh cheese with different flavours
4. Yoghurt, different flavours
5. Petit swiss cheese, different flavours
6. Reconstituted fruit juices

The processes to make cheese, yoghurts are very good and flavours are quite well developed.

The process to pasteurize milk and reconstituted fruit juices is not very good, because both products remain exposed to high temperatures for too long. This degrades the natural flavour, giving the above products a burnt taste and smell.

In order to solve this problem, new equipment is recommended, a compact equipment for vegetable juice extraction which could be very useful to reconstitute milk from milk powder, sterilize milk and fruit juices. This equipment works 200 litres per hour and renders a sterilized product which means the final product lasts longer than pasteurized. Besides this advantage, the milk or juice is heated for 2 minutes only in a stainless steel coil and cooled immediately.

This equipment is also recommended for the Fruit and Vegetable plant, because it is used to extract fruit juices, pulps and make fruit nectars, juices, pulps. Also can be used to extract coconut milk, soya milk and other vegetable juices as soups for example.

It would be interesting for this dairy plant to diversify it's line of final products by adding some new ones, as condensed milk for example. The condensed milk could be made by reconstituting evaporated milk and mixing with cane sugar, in the following way :

620g sugar
280g milk
100g water

1000g sweetened condensed milk.

This product is used very widely in the islands, and is good because it lasts longer than any other product because it's final concentration avoids micro-organisms developing.

The sweet condensed milk could be made in the present equipment which is now being used to reconstitute and pasteurize milk juices. While the new equipment would be used to do those above present final products.

Cleaning of Dairy Equipment.

1. After production is finished, the equipment should be immediately washed with fresh water or hot water.

2. Pass a Nitric Acid solution of 1% concentration hot and recirculating it for 15 minutes.

3. Pass water again to remove all nitric acid.

4. Pass NaoH (sodium hidroxide) - 1% hot and recirculating it for 15-20 minutes.

5. Pass fresh water until all Na oH has been removed, and comes out completely clean.

This cleaning and sterilizing procedure is very secure, cheap and simple. Avoids buying expensive cleaning solutions. Care should be taken in order to avoid this procedure for equipment not made of stainless steel, otherwise this type of equipment would be corroded.

The fruit and vegetable processing plant which we are recommending through UNIDO help, could well be added to this dairy plant. This would save initial investments, such as : water supply, electricity, buildings, offices, laboratories, telephone, telex, management hand labour, part of equipment, cold room, pick up, cars, etc..,

The compact extraction equipment which we are recommending for the dairy plant could also be used to produce, fruit juices, nectar, coconut milk, etc.. This would reduce the investment for the new plant.

Instead of two or three of this equipment for the new plant, only one or two should be bought.

The fruit and vegetable reception and preparation line should be added to the dairy plant, where they presently have the bathroom and laboratory, starting from the back of the plant and coming inside the processing plant which presently has enough space to be used.

The cheese production is very small and all the space they devoted for this purpose is very idle, also the cheese vats , which could be used for some new purpose.

If the fruit and vegetable processing plant of our UNIDO report should be added to the dairy plant, the following investment should be made.

| | US$ | |
|---|---|---|
| 1. | 2000 | |
| 2. | 2000 | |
| 3. | 4000 | |
| 4. | 4000 | |
| Transport | 12000 | |
| 5. | 25000 | |
| 6. | 1500 | Installation : 20% of investment |
| 7. | 500 | US$ 15.000.00 |
| 8. | 2000 | |
| 9. | 1000 | |

ANNEX 3 (Cont'd)

| | | |
|---|---|---|
| 10. | 6000 | Airway tickets, staying of two technicians for 1 month. |
| 11. | 500 | |
| 12. | 2000 | |
| 13. | 500 | US$ 18.000.00 |
| 14. | - | |
| 15. | 5000 | |
| 16. | 5000 | |
| 17. | 4000 | |
| US$ | 75000 | |

Building : US$ 30,000.00

All investment would come out to be around US$150,000.00.

Description of equipment can be seen in the UNIDO report of myself. Numbers of equipment quoted are the same as in UNIDO report.

P.S. It is also recommended to pass fruit juices through sterilizer and filling the doypack sachet at 80-85oc closing and cooling the filled closed sachet in cold water bath. This process would keep fruit juices at room temperature for 2 months, but this can only be made with the new equipment.

ANNEX 4

MINISTRY OF AGRICULTURE AND LAND USE

P. O. Box 54, Botanical Gardens, Republic of Seychelles.
Telex : 2260 SEYGOV SZ Telegrams : AGRICULTURE, Seychelles Telephone : 22314/5.

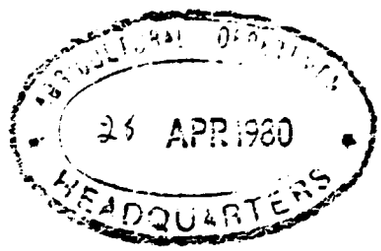
Please address all correspondence to the

Your Ref :
Our Ref :
Enquiries To :
Telephone Ext :
Date :

TO WHOM IT MAY CONCERN

I have greatly enjoyed meeting Professor Roberto H. Moretti and have been much impressed with his report concerning "Fruits and Vegetables" it is my wish that his suggestions will lead to the establishment of this new industry. I believe that my Government might need, during the implementation of the scheme the valuable advice of Professor Roberto H. Moretti.

Thanking him.




K. St. Ange
MINISTER OF AGRICULTURE

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