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IMPROVING PRODUCTION OF AUNT LUCIE'S LTD.

ST/STL/88/801

SAINT LUCIA

Terminal report*

Prepared for the Government of Saint Lucia
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Yoram Levtov, expert
in food processing and quality control

Backstopping officer: S. Miranda da Cruz, Agro-based Industries Branch

United Nations Industrial Development Organization
Vienna

* This document has not been edited.

V.89-57017 (EX)

CONVERSION TABLES

1 lb	454 g
1 kg	2.20 lb
1 oz (weight)	28.35 g
1 oz (fluid)	29.57 g
1 cc	1 ml
1 pint	473.12 ml
1 quart	946.24 ml

1 gallon (US) = 3785 ml = 3.785 litres

Specific density for JAMS at 65 Bx° = 1.3

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Annexes

I. INTRODUCTION

The first phase of the mission started with a one day briefing in UNIDO headquarters in Vienna. There was another day of briefing in Bridgetown, Barbados, with Mr. Peter Ryan, Senior Industrial Development Field Advisor for UNIDO for the Caribbean area. Mr. Ryan was personally involved in the preparation of the project document and was very familiar with all the project's aspects. Interviews were also held with Mr. Arie Koole, UNIDO Junior Professional Officer (JPO) for the area, and Mr. Antonio Vigilante from the UNDP office in Bridgetown, who is in charge of all United Nations projects in Saint Lucia.

The following documents were studied:

- World Bank - St. Lucia Economic Memorandum - March 15, 1988
- Ministry of Agriculture, Castries, St. Lucia - Agricultural Diversification in St. Lucia - February 1988
- Project Document - SI/STL/88/801 - Improving production of Aunt Lucie's Ltd. - June 22, 1988

On arriving in Saint Lucia, I was met by the plant's General Manager, Ms. Marie-Celine Lawrence, who proceeded in giving a detailed picture of the actual situation. After that, work started at the plant in Dennery.

During the first days, meetings were held in Castries with Ms. Jacqueline Emmanuel from the Ministry of Planning, who is in charge of this project, and the Board of Directors of Aunt Lucie's Foods, in which three of the four Directors participated.

Participated in this meeting:

Mr. Ferrel Charles - Chairman
Mrs. Charmaine Gardner
Mr. Geoffrey Devaux
Mr. Stanley Mullings - was absent

The Directors expressed their concern for the plant's future, and asked questions regarding the various aspects of the mission.

Before leaving the country, another meeting was arranged so that the findings and diagnosis of the actual situation could be transmitted to them.

After completing the first phase of the mission in Saint Lucia, the UNDP office in Barbados was visited and working sessions were arranged with Mr. Peter Ryan, Mr. Arie Koole and Mr. Antonio Vigilante. The Interim Report was discussed with them.

The budget set aside for the laboratory equipment is enough for purchasing laboratory equipment for a plant many times larger than Aunt Lucie's.

The visit to Barbados was followed by a visit to UNIDO headquarters in Vienna, where the report, as well as the second phase, were discussed with Mr. Sergio Miranda da Cruz, who is the backstopping officer for this project.

The second phase of the mission started with a short visit to the UNIDO office in Barbados; however, Mr. Ryan was out of the office on a field trip and left some written instructions.

The mission in Saint Lucia started on 17 January and lasted until 28 February.

After completing the diagnosis during the first phase, the second phase was used more for personnel training and execution of some of the conclusions arrived at in the first phase.

It should be noted that one of the Directors, Mr. Geoffrey Devaux, is now taking a very active part in operation of the company.

Unfortunately, the same kind of problems observed in the first mission still exist and will be discussed in the following Chapters.

On Monday, 13 February, a meeting was held with the Plant's Board of Directors, with the participation of the Plant Manager as well. In this meeting, the various aspects of a plan for future recovery were discussed.

II. ACTIVITIES CARRIED OUT DURING PHASE I OF THE MISSION

2.1 Plant Evaluation

The major part of the time of the mission's first phase was spent at the plant in Dennery in order to evaluate its situation. During this time almost all of the products normally produced by the plant were elaborate, including:

- Orange marmalade in jars and portion packs
- Guava jelly
- Guava jam
- Soursop jam
- Mango jam
- Pepper sauce
- Pineapple jam

Only grapefruit marmalade and mango chutney were not produced.

Each process was carefully observed from the moment the raw materials were received until the products were labelled and packed in cartons; equipment, manpower, production procedures, quality control and record keeping were observed. An active part was also taken in other production-related activites, such as sugar purchasing, delivery of fruit produce, obtaining fruit for experiments.

During this time good working relations were established with the senior personnel of the Dennery Farm Co. and the Caribbean Agricultural Research and Development Institute (CARDI), which proved to be very helpful.

The result of this activity is a detailed diagnosis presented in Annex I of this report, and the estimate of the production costs, presented in Annex II.

2.2 Quality Control

After observing the problems with the refractometers an effort was made to calibrate them, but it was fruitless; two other refractometers were obtained from the Union Laboratory in Castries. In order to gain time, a list of necessary equipment and chemicals for quality control was determined and sent to various manufacturers in the United States of America. By the end of the first phase of the mission only one answer was received.

This meant that analysis of the quotations and purchasing could only take place during the second phase.

However, the manager of the Caribbean Agricultural Research and Development Institute (CARDI) promised to loan all the necessary equipment, and therefore chemicals were ordered from Barbados so that actual work could be done during the second phase.

2.3 Literature

No literature regarding the processing or quality control of the food products could be found at the plant or anywhere else; therefore, letters were sent to publishers for quotations on basic text and reference books.

At the same time, a request for standards was sent to the FAO and WHO in Rome via the Ministry of Planning.

2.4 Plant Equipment

Observing the production of Orange Marmalade and Pepper Sauce, it was found that two simple pieces of equipment of the size used in institutions such as hotels and restaurants could completely change the production.

2.5 New Product Development

Samples of three new jams were produced:

- Pineapple-Banana Jam
- Passion Fruit-Banana Jam
- Orange-Banana Jam

Samples were given away to various persons for taste testing; their opinions were positive, especially in the case of the Passion Fruit-Banana Jam.

However, cost calculation showed that these products would not be cheaper than the existing jams.

For these experiments a gas range was purchased, allowing the production of small batches (5 lbs) at a time.

In order to develop a frozen mixed drink concentrate which could have a good market at Saint Lucia's hotels, letters were sent out asking for the proper chemical ingredients.

2.6 Raw Material Storage

At the moment, the plant does not have any way to store raw materials. A simple method of preserving fruit with sulphur dioxide is recommended. Producers were contacted and asked to send samples to Saint Lucia so this method can be put into operation during the second phase.

2.7 Marketing

Considering the great importance marketing holds for Aunt Lucie's future, a meeting was held with the personnel of Dynamic Marketing Ltd. Supermarkets and stores were visited and a questionnaire was sent to all major hotels in Barbados and Antigua.

Meetings were arranged with food and beverage managers in some of the hotels in order to learn their attitude toward locally produced products.

III. ACTIVITIES CARRIED OUT DURING PHASE II OF THE MISSION

3.1 Personnel Training

A very important activity in the second phase of the mission was a training course in jams, jellies and marmalade manufacturing and quality control with emphasis on the latter.

This was rather a complicated task considering that the participants (all plant personnel) had never studied the basic sciences such as physics and chemistry necessary to understand the process of production and quality control in the food industry.

In addition, the participants had been out of school for more than ten years, and it was very difficult for them to enter into the atmosphere of studying.

It is believed that from six participants, only two have captured the total of the material discussed during the course and will be able to make full use of it in the future.

The course was composed of two parts. The first was theoretical, where units and measurement, basic chemistry and physics were presented first, while more details of jams, jellies and marmalade production followed. Quality control methods were discussed.

The second part included practical work with equipment and chemicals used for food analysis in the laboratory.

Both parts included a lot of practicing and repetition in order to give the participants time to absorb the difficult material.

The selected parts of the course were printed and given to the participants.

More details about this course are given in Annex III.

3.2 Laboratory Equipment and Chemicals

It was rather an unpleasant surprise to find out that from all the requests for chemicals and laboratory equipment sent out during the mission's first phase, only two answers had been received. Fortunately, these answers came from the largest companies in this field in the United States of America (Fisher Scientific, Curtin-Matheson).

After analyzing the offers, it was decided to order the laboratory equipment from Curtin-Matheson and the chemicals from Fisher Scientific. During the first days, the material was processed and sent over to Mr. Ryan, UNIDO Senior Industrial Development Field Adviser (SIDFA) in Bridgetown, Barbados, in order to start the purchasing process. The list of equipment and chemicals to be purchased are given in Annex IV.

3.3 Extended Diagnosis

After elaborating a very detailed diagnosis during the first phase of the mission, a model working day has been selected to reflect the plant's possibilities

with the equipment and manpower on which it can count at the moment. This model is a conservative one and considers the production of 500 16 oz. jars (550 lbs.) of marmalade a day, cooking four batches. When producing portion packs or pepper sauce, equivalents are used.

This model was adapted in all of the cost calculations and served as a basis for the analysis of production cost.

During the second phase of this mission this capacity was only achieved on very few days.

A very careful observation of the situation was made during this phase and a discussion of the problem appears in Annex V and in Chapter IV - Conclusions and Recommendations.

3.4 New Process Equipment

In order to be able to change and make simpler and much more efficient the processing of some of the products, some pieces of equipment should be purchased. The new processes are described in detail in Annex VI.

Again, from quite a few requests sent out during the last mission, only one answer had been received. Also in this case, the answer is from a world leading producer of this equipment and the prices are right.

A request for purchasing these units, including the justifications, was sent to Mr. Ryan in Bridgetown, Barbados so he could start the purchasing procedures.

During the first phase of the mission an observation was made that the scale used for weighing sugar and pectin, etc., which is vital to the proper operation of the plant, is not in very good mechanical condition. It was taken down to a shop and repaired. However, the scale is again not functioning properly, and it must be changed.

In order to save time, an effort was made to find a scale in Saint Lucia so that a local purchase could be made. After visiting practically every hardware store in Castries, a scale answering our requirements was found at WITECO. It then took a long time and quite a few telephone calls before we managed to get a quotation for the scale. The price is a little high, but considering the weight necessity for this unit, a local purchase is justified. All the necessary details have been forwarded to the UNIDO office in Bridgetown, Barbados, so that the purchase will be authorized and the funds transferred to Saint Lucia.

The main correspondance regarding the purchase of the new equipment is presented in Annex VII.

3.5 Maintenance

During the first, as well as the second phase of the mission, quite some time was dedicated to mechanical and maintenance problems. Detailed recommendations regarding machinery and equipment were given in the Interim Report. Unfortunately, the situation became even worse and work was stopped many times because of mechanical problems. As already discussed in the Interim Report, the boiler feed pump is very old and hardly in working condition. It is not working properly and causes interruption in the production process where the

steam is essential. A great effort was made to find a proper pump on the island, but it was fruitless. The only company which could provide one was WITECO. However, they never came through with a quotation (despite several telephone calls).

Giving up on WITECO, letters were sent to Miami asking for quotations; as of date, none were received.

According to discussions held in Vienna and Barbados, there is a good chance that UNIDO will finance the purchase if we can get the proper quotation.

In any case, the plant cannot operate without this pump, and an effort must be made to find one.

It is worthwhile mentioning that in December some of the boiler tubes leaked and it was necessary to block them.

This was probably caused by introducing cold water into the boiler when the feed pump did not work. It must be taken into consideration that this boiler has been working for five years using untreated water of very bad quality. The degree of corrosion of the tubes is probably advanced, and this method of introducing cold water into the hot boiler should never be practiced again.

During the mission some small maintenance jobs were carried through in the plant together with the mechanic. The water system was fixed, steam traps cleared, pressure valve checked, etc.

It was already observed during the first phase that the mechanic does not have the proper tools. Every time something breaks down, he must first acquire the proper tools before he starts the slow and tedious process of repair. This causes major loss of production time. Therefore, a list of necessary tools was prepared, prices obtained and tools purchased.

3.6 New Products

During phase II of the mission, two new products were developed.

The first one is a green pepper sauce which intends to solve the problem of green peppers received at the plant together with the yellow and red ones. At the moment, these peppers are discarded at a time when peppers are extremely difficult to obtain. In taste, there is practically no difference between the green and regular pepper sauce. Samples should be made for testing the market's acceptability for this product.

Rum Orange Marmalade was developed and judged very favourably by those who tasted it. This product is intended for the gift packages.

Formulas and processes for these products are given in Annex VIII.

An experiment in repacking peanut butter was carried out at the plant and the results and costs are given in Annex VIII.

3.7 Cost of Production

Revised cost of production for pepper sauce (because of a change in formula), mango chutney and rum orange marmalade are given in Annex IX.

Sale prices for some of the products were changed, and therefore a summary of the cost of production for all the products is given in the same Annex.

Also, a change in labour cost starting January 1989 caused a small rise in the cost of production per person. However, the number of floor workers was reduced from 7 to 5, and as a result, the labour cost remained the same.

The raise in salaries was designed in such a way that the total monthly payroll remained the same.

Therefore, it is not necessary to revise the cost of production for all the products. It is only necessary to take note that the labour cost is the same having fewer workers while each of them earns more.

IV. CONCLUSIONS AND RECOMMENDATIONS

A. PHASE I

4.1 General

From the diagnosis presented the major conclusion is that the future of the plant depends on its ability to substantially increase its sales volume. Sales in 1987 totalled EC$ 98,126.64, which represents 29,467 16 oz. jars or 59 working days using a modest 500 jars (four batches) a day production (this calculation is approximate, because it does not represent the mixture of products at different prices).

An approximate calculation shows that the break-even point will be achieved by working 150 days out of the 240 working days in a year, or at 62.5% of the total production. This calculation is also based on the production of 4 batches every day for the total of 550 jars, each containing 1.1 lb.

An effort to cut down production costs should be made. Two good starting points will be:

- Cheaper packaging materials (although of lesser quality) can be obtained in Latin American countries such as Venezuela and Brazil and maybe even in Puerto Rico.
- Sugar is US$ 0.237 per lb. at the moment, while the price for raw sugar FOB Caribbean Port is US$ 0.105 per lb. Crude (yellow) sugar can perfectly substitute the refined sugar used at the moment without causing any change in the product quality. Price of pectin and citric acid, although not representing much of the total cost, are very high.

Letters were sent out in order to try to find cheaper sources for these materials.

It is expected that all recommendations made in this section under Technology and Process and Quality Control, will be carried out and completed during the second phase of the mission.

4.2 Marketing

A strong and aggressive marketing drive is necessary in order to increase the sales volume and some ideas in this direction are given below:

- Use the good services of the Chamber of Commerce, Industry & Agriculture in order to pressure the Saint Lucia Hotel Association to buy more locally-produced jams, jellies and marmalade.
- Use the same questionnaire sent to Barbados and Antigua in all the other islands in the Eastern Caribbean and as far as Aruba and Curaçao.
- Periodical visits to supermarkets and stores, followed by pushing merchandise to them.
- It will also be necessary to obtain the price of the imported products and analyse their quality from time to time.

*4.3 Raw Materials

- Develop the sodium bisulphate methods to preserve raw materials. Change production methods for those cases where preserved fruit is used instead of fresh fruit.

- Record weight and yields in all fruits (pulp or juice from fresh fruit) even when the fruit is bought by the unit (mango).
- Record Brix, acid and pH of the fruit.

*4.4 Technology and Process

- Change production procedures for the following products: Orange Marmalade, Soursop Jam, Grapefruit Marmalade, Guava Jelly.
- Change completely the process for pepper sauce to achieve better yield.
- Change the batch size to 220 lbs. (raw materials).
- Solve the foaming problem and change the process accordingly.
- Write detailed procedure for each product.
- Prepare production control sheets.

*4.5 Quality Control

- Prepare basis standards for all products.
- Prepare procedure for quality control analysis.
- Prepare control and recording sheets.
- Train the personnel in testing methods and equipment handling.
- Do a yield calculation for every batch.

4.6 Building

- Install an air extractor above the cooking kettles.

4.7 Maintenance

- Establish a maintenance schedule and weekly report.
- Establish procedures for boiler blow down.
- Clean the nozzles on the (boiler) burner.
- Establish a stock of spare parts.
- Change the position of the manual valves letting steam into the kettles.

4.8 First Aid

- Have ready an ointment for burn treatment.
- Have ready some antidote for bee stings.

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* To be carried out and completed during the second phase of the mission.

B. PHASE II

4.1 General

It must be observed with great regret that since the mission's first phase no substantial advance was made by the plant, as a series of problems expected and unexpected caused interruptions in the normal production process.

The major reasons for this are discussed in Annex V (Extended Diagnosis).

The good news is that since 1 February 1989, the plant has a permanent experienced salesman who will distribute the products all over the island, hopefully increasing substantially the local sale. Some new international contacts were made, giving hope for exports in the future.

Most of the recommendations made in the Interim Report are still to be implemented, with the exception of the Technology and Processes, where the boiler's situation does not permit any changes in either the size of the batch or in the way of elaboration.

If ever a new boiler is acquired, its working pressure should be raised to 90 - 100 psi and the size of a batch to 300 lbs. of raw materials.

Until then, work should continue with the same size batch with the target of cooking 4 batches (500 jars) per working day during the five working days of the week.

The following specific recommendations are made:

4.2 Marketing

It seems that with pressure applied on the Saint Lucia Hotel Association by the Chamber of Commerce, Industry & Agriculture, the sale of portion-packed products to the hotels has increased. A first order from Barbados was placed on 17 February. The services of the salesman should be used to bring feedback from the customer to the plant in order to improve quality and service.

Efforts should continue to introduce the products in other countries, specifically in the Caricom region.

4.3 Raw Materials

Because of the lack of adequate containers (plastic drums with tight lids), fruit was not preserved; however, the method is so simple that it could be applied very easily. Five grams of Sodium Bisulfate for every kg. of product in the container, regardless if it is blended pulp or whole fruit in water. (The total weight should be considered.)

The Sodium Bisulfate should be first dissolved in a small amount of water and then added to the drums and its content mixed, and the drum hermetically closed.

More raw materials should be purchased daily, even at the risk that some of it may spoil.

4.4 Technology and Process

As long as the boiler is not changed, the methods used now should be kept.

When the equipment ordered (citrus juice extractor and blender) is received, the plant production methods for orange and grapefruit marmalade and pepper sauce should be changed as described in Annex VI.

4.5 Quality Control

Once the equipment and chemicals arrive at the plant, a full quality control scheme should be put into effect.

The best qualified person to handle the quality control is the plant's supervisor and should be made fully responsible for it.

All details for the quality control scheme appear in Annex X.

4.6 Maintenance

The key point in the plant's operation now is the boiler, and it must be kept working at all times.

Therefore, the maintenance man must spend most of his time at the plant, even at the cost of neglecting some of his other activities.

4.7 Production Planning

After a few months of working with the salesman, the trend of sales will be established. A sales programme can then be established for next year.

Using this sales prognosis the purchase of raw materials, packaging and auxiliary materials should be programmed, and a tentative production plan on a yearly basis elaborated.

4.8 Communication

There is a major problem in communication between the plant in Dennery and the office in Castries. The telephone is out of order most of the time.

A lot of wrong decisions could have been avoided if the flow of information had been operating all the time.

Usually at the plant level it is preferred to stop production rather than continue at the appearance of any kind of problem. Raw material is not purchased until the problem is solved, usually causing a loss of a full day's production.

The decision-makers either in Castries or in Dennery have to take them many times without the necessary data.

If there is no way of getting the telephones to operate properly, another way of communication should be arranged by purchasing a CB radio or something similar.

4.9 Technical Assistance

I found Mr. Henry Lubin, the government chemist, a very well trained and experienced professional, and always very helpful.

In cases of technical problems in quality control and production, Mr. Lubin should be consulted.

He has a properly equipped laboratory and all the basic chemicals, as well as a technical library.

I am sure that in the future Mr. Lubin can contribute a great deal to the quality control scheme at Aunt Lucie's.

ANNEX I

DIAGNOSIS OF AUNT LUCIE'S FOODS LTD.

1. Introduction

Before going into a detailed diagnosis of the plant's operation, some special considerations must be taken into account. Usually the capacity of a plant producing jams, jellies and marmalades is determined by its cooking capacity. All other operations are usually designed in such a way so that enough raw materials can be supplied on time for the cooking operation, on one side, and the end product can be handled on the other.

Aunt Lucie's plant being designed as a training centre rather than as an industrial operation was not set up this way; therefore, its cooking capacity is much higher than its possibilities in either preparing raw materials (pulps) for the cooking, and for proper handling of the final products. In order to be more specific, the following calculations are presented:

A. The plant has two 80 gallon stainless steel steam jacketed kettles, each of them able to cook batches of 220 lbs. raw materials at a time.

B. A full cycle of cooking, including loading the raw materials and emptying the final products, takes one (1) hour.

C. A working day consists of seven and one half hours; however, time should be left for preparing raw materials for the first batch and packing the end product of the final batch. Therefore, only six cookings per kettle every day are considered. In all, 12 batches a day can be cooked.

D. For this operation, 2,640 lbs. (220 lbs. x 12) of raw materials should be used, half of which is fruit pulp.

E. Considering an 80% industrial yield (end product from raw materials), 2,112 lbs. of final product will be obtained.

F. Packing the products in a 16 oz. jar (1.1 lbs. product in the jar), 1920 jars will be needed.

The steam boiler - 15 HP, operating at full capacity, is able to supply the required amount of steam. However, actual production is far below this figure. Going over the records for 1987 and 1988, a maximum of seven batches in one day was recorded only once, and after raw materials were prepared the day before.

After observing production during the first phase of the mission, and checking the records for 1987 and 1988, it seems that on an average day of production, four full batches of product are prepared, cooked and packed. Considering all the above-mentioned aspects, the diagnosis tries to analyse the current situation based on four batches a day of production. (The same figure of four batches a day was also used as a basis for the cost of production calculation for each one of the products.)

2. Raw Materials

From seeing and checking the raw material during the first phase of this mission, and discussing the problems with the manager and plant supervisor, the following observations can be made.

2.1 Sources

Most of the raw materials (fruits) are locally grown in the areas around the plant in Dennery. There are no contractual agreements with supplies. Raw materials arrive at the plant without previous advice, which makes it impossible to make any long range production planning. Of course, relations were established with some of the farmers growing fruits, and they can be asked to bring in some fruit in special cases. However, it was observed that farmers did not consult the plant about its necessities, they just bring their fruit and expect the plant to buy it.

A special case is the pineapple which is being imported from Martinique. Chemical products used in the process, such as pectin and citric acid, are imported from the United States of America. Sugar is bought locally from government supplies (imported). Packaging materials are imported from France (last shipment of jars) and portion pack from the United States of America.

The plant does not have any storage facilities which would allow it to keep fruit for a period of time. That means that in most cases (except for citrus), the fruit must be processed within a maximum of 2-3 days of its purchase, dependent upon the grade of its maturity. (A freezer with some 25 cu. ft. capacity provides very little relief from this problem.)

On the other hand, packaging materials ordered by container load occupy a substantial part of available floor space.

2.2 Quality

The quality of fruits received at the plant during the first phase of this mission was of a lower standard, referring specifically to its flavour.

Fruit received at the plant was usually wholesome and in good physical shape and showing very little outside damage. However, sugar content was low, colour pale and flavour weak; of course, poor quality fruits make it impossible to produce good quality products. Oranges received were completely green, and the rind after cooking acquires a dark colour which affects the appearance of the final product. The only good surprise was to find the guavas completely free from the Mediterranean fruit fly.

The quality of the chemical products is good, and that of the packaging material excellent. Quality of sugar is also excellent.

2.3 Prices

Most fruits are bought at the plant's gate at 30¢ per pound, which is equal to 11¢ US per pound, or some US$ 240 per metric ton. These prices cannot be considered cheap. However, it should be taken into consideration that the cost of fruit does not greatly affect the cost of the final product.

The case of pineapple is an exception, and of course it is reflected in the cost of the final product. Prices for chemical products are very high, and the same goes for the packaging material. The price of sugar is also high.

3. Utilities

Three utilities are used at the moment in the plant: water, electricity and gas, which is used to operate the steam boiler.

3.1 Water

The supply to the plant comes from the main system supplying drinking water to Dennery. Most of the time the pressure is low and it is hardly enough for the plant's requirements.

The quality of the water at this time of year (rainy season) is very poor. The water contains a high percentage of suspended solids, so high that some of it settles to the bottom of a container if left standing overnight.

The price of water is negligible.

3.2 Electricity

There is a good supply of electricity to the plant at 220 - 240 volts 50Hz with the ability to obtain 3-phase connection. The electricity is cut off every once in a while, but generally it is a dependable service. Price, including all charges, is 0.35¢ per KWH, which is high.

3.3 Gas (LPG)

For the steam boiler, LPG gas is used. The gas is delivered from a truck to a fixed tank. There are problems getting the delivery on time. Price of gas is EC 1.025¢ per pound.

4. Technology

Presently, the plant operates at two levels of technology. While the cooking of products is done on the level of a small scale industry, the preparation of pulps from raw materials for cooking, and the bottling, labelling and packing are definitely artisan work.

The only reason the plant can work in this way is that it is operating way below its installed capacity. The preparation of citrus juices is a slow, tedious, time-consuming process, where the fruit is hand peeled, then cut in half, and then squeezed again by hand to obtain the juice. In cases where pulp is needed, the pulping operation is done by home-size blenders in batches of 1.25L at a time. By the time the last of the fruit is pulped, the first batch has started to ferment. This part of the process will have to improve by purchasing larger size equipment for this operation.

The packing operation is completely manual; however, it does not take up too much time. A more time-consuming operation is the labelling process, which is also done entirely by hand. Even for the portion packing machine, except for the packing itself, the rest of the operations are manual.

Once the plant starts to operate at a higher capacity, this problem will have to be solved by adding equipment.

5. Building

The plant is housed in one single hall of 75 ft. x 32 ft., with walls painted white. It has a smooth concrete-finished floor and high windows which give good ventilation.

Most of the windows are covered by mesh screens against insects. The ceiling is at 10 ft. and is low for an industrial plant, causing accumulation

of water vapour above the cooking kettles. Between the roof and the ceiling an attic is found, and about half of it, 43 ft. x 32 ft., is used by the plant as a storage space for cartons and bottles.

The classical separation between raw materials (fruits) storage, preparation, industrial processing, and storage of final product does not exist. A considerable amount of the total space is taken by packaging materials and working tables, which are only used for cooling the filled jars.

Adjacent to the main building are the boiler room and workers' facilities. In fact, everything in the plant, with the exception of the two cooking kettles, can be shifted around very easily in order to obtain a new layout at any desired moment.

6. Machinery

The number of industrial machinery units at the plant is limited and includes: 2 steam jacketed-kettles, a steam boiler, a portion packing machine. A more detailed description is given below.

Kettles: Two 80 gallon fixed kettles made of stainless steel mounted on three legs. Heating is done by steam entering the double jacket. Working pressure is 55 psi (4 ATM). The kettles are complete with steam-traps, pressure gauges, safety valves and a condensation returning line. The kettles are emptied by a 2" valve at the bottom. A wooden platform is used for the operator. These kettles were produced by Groen-USA in 1966, and are still in very good condition.

Steam boiler: A vertical steam boiler operating on LPG gas with 15 HP (steam) output. The boiler was built in 1984 by Eclipse Lookout Co., United States of America. It comes as a complete unit, including water supply positive pump, automatic control, etc. The boiler is generally in good condition, but needs servicing to keep it in good working order.

Portion packing machine: A small portion packing machine with a speed of 28 units per minute, made in the United States of America and supplied by R.H. Packaging Systems Inc. The upper part of the unit is completely made of stainless steel. It is driven by a 1/3 HP motor and supplied with air from an air compressor with a 1 HP motor. The unit arrived in 1983 and seems to be in good operating condition.

The plant also has a paddle pulper finisher with one set of screens, on loan from the government's Produce Laboratory.

7. Manpower

The total permanent staff of the plant includes a supervisor, mechanic-driver and 6 floor workers, all of whom have been working for quite some time at the plant.

The supervisor, as well as all the floor workers, have gone through the Youth Training Skills Program - Food Processing Course, organized by USAID. The supervisor was sent then to the United States of America for additional training. The following impressions were made of the plant's personnel:

Supervisor - A very intelligent person, knows very well all practical sides of the work done at the plant, manages her staff and the suppliers of raw

materials very well. Unfortunately lacks basic knowledge of chemistry, which would have helped to improve quality control techniques.

Mechanic - Although without official technical training, has a good approach to technical problems.

Floor workers - All are well trained in the operations at the plant and need very little supervision.

8. Marketing

Apparently the most difficult problems facing Aunt Lucie's at the moment are in marketing. On the current volume of sales the company is losing money, more money has to be borrowed for working capital, and the financial costs are going up.

As already mentioned, the plant operates only in part of its installed capacity and could easily produce much more.

The company does not have a sales department or a sales manager, and the usual method of doing business is waiting for customer orders. The major part of the products are sold through supermarkets and a small part to hotels and restaurants.

It is strange that most of the large hotels in Saint Lucia prefer imported jams and marmalades over the local product which is of the same quality. Comparing the quality of orange marmalade made by Smucker's, one of the leading American brands, and Aunt Lucie's product, the latter was superior, especially tastewise.

In order to be able to evaluate better the situation, meetings were arranged with the Food and Beverage Managers of some leading hotels in Saint Lucia, such as the St. Lucian, Halcyon Beach Club and Cariblue.

However, no clear-cut conclusion may be obtained from these meetings because opinions expressed were quite different from one place to another.

All of these indicate that without a good price difference between the local and imported product, they prefer an imported one.

The Cunard Lines Inc., which operates the La Toc Hotel in Saint Lucia, is interested in developing gift packages to be given away in all of their hotels in the area. This would be an excellent opportunity to develop further the international market and increase sales considerably.

Another opportunity is to custom label packing for Dynamic Marketing Ltd. of Trinidad. (Aunt Lucie's will directly make and pack the products under labels supplied by Dynamic Marketing.)

The first phase takes into consideration the purchase of 400 cartons (4800 jars) per month of assorted products. In a personal meeting with Mr. Glenn Lee Fook, Managing Director of Dynamic Marketing, he indicated that a competitive price rather than high quality is his chief concern, and that he strongly believed that more of Aunt Lucie's products can be sold in the Caribbean market.

9. Maintenance

The importance of maintenance is obvious, especially in such a small place like Saint Lucia where replacement parts for equipment and machinery are very difficult to obtain. Unfortunately, preventative maintenance is not practiced at the plant, and only when a machine breaks down, it is attended to (usually causing a stop or delay in production).

During the first phase of the mission the following points were observed:

- About 30% of the nozzles of the gas heater for the boiler were plugged, reducing considerably its capacity in steam generation.
- The water pump (positive pump) supplying the boiler was not working properly and not pushing enough water into the boiler. Therefore, the automatic water level control was shutting down the boiler until the desired level could be reached, causing a stop in the cooking process. Finally, the pump broke down completely.

  The problem was caused by a simple washer, but not having one in stock, the line had to be disassembled and the pump taken to Castries for repairs. The pump is driven by a motor mounted on top of it, using pullies and a belt in order to transmit the power. The relation between the diameter of the two pullies is not proper, causing the belt to slip, so that the pump is losing a part of its capacity.
- The rubber belt driving the portion pack machine was too loose. It was replaced, and the unit works very satisfactorily.
- The pressure gauge on the steam line is not working and should be changed.
- The blow down of the boiler is not done according to the manufacturer's instructions.
- Various steam and water valves are leaking.
- The scale being used to weigh ingredients for production was not working properly. It was fixed with the help of the manager of the Dennery Farm Co. Workshop.
- The pulper was standing on three wheels (out of four), making it dangerous to use because it could fall and hurt the operator. The other wheels were removed in order to stabilize it.

10. Quality Control

At the moment, very little quality control is practiced at the plant; however, it should be mentioned that the final products are of good quality usually. Referring to their sensory characteristics such as colour, flavour, taste, appearance and texture, these products can definitely compete with the quality of products imported from other countries for the hotels on the island. However, Aunt Lucie's products are not as uniform as the imported ones.

On the plant level, no quality control is applied to raw materials (see Raw Materials).

Brix (sugar content) and pH are tested on the fruit pulp, and a Brix reading determines the final point of cooking.

However, on arriving at the plant it was immediately noticed that both refractometers for the low range and for the high range were not working properly.

Those were replaced by others loaned from the government's laboratory, which now seem not to be working very well either.

Searching through the cabinets, an hydrometer for the range of 0-15 Bx° was found and was used to replace the low range refractometer; unfortunately, it broke. An effort was made to calibrate those refractometers against a good bench refractometer, but none could be found so far.

The pH meter was not being operated properly. It was not adjusted to the ambient temperature in Dennery, and the electrode was not properly washed after use. These points have already been corrected.

No tests are carried out on the final products.

The records only state the amount of raw materials (fruits) used and the amount of products obtained, the Brix and pH (not always) of the pulp, and the cooking time.

There are no control sheets for production, and no yield calculation is done for every batch or on a daily basis.

ANNEX II

COST OF PRODUCTION

An example of yield calculation is given below using mango jam. The same type of calculation is done for all other products. The basis for the calculation is a sugar balance matching sugar inputs and output in the working process.

SUGAR BALANCE

Usually the yield should be around 80%.

SUGAR

$270 \times 10/100 + 270 \times 100/100 = X$ Final product $\times 68/100$

$27 + 270 = X \times .68$

$X = 297/.66$

YIELD: $X = 436.8$

$436.8/540 = 80.9\%$

YIELD should be around 80% at 500g/jar.

There are various ways of calculating the production cost for each product made by the factory. Bearing in mind that the plant does not utilize its installed capacity, and after considering some alternatives, the calculation was done based on the following factors.

1. Price was calculated for a 16 oz. jar with a net content of 500g - 17.64 oz. (1.1 lb.).
2. Daily production 500 jars from four (4) batches.
3. One working day is sufficient for all production operations, from preparation of fruit to labelling of final product. (In reality, labelling and packing are done at a later date.)
4. Final sugar content in all products (jams, jellies, marmalades) is 68 Bx%.
5. With very little local data available, yields of pulp and juice from fresh fruit take into consideration data from other countries.
6. No depreciation is calculated because the plant was donated without any additional investments.
7. Maintenance costs are negligible.
8. There are twenty (20) working days each month.

YIELDS

The following yields represent the amount of pulp or juice obtained from fresh fruit:

ORANGE	42%	Brix 10°	Price:	30¢/lb.
PINEAPPLE	60%	Brix 6 - 10°	Price:	30¢/lb.
GRAPEFRUIT	30%	Brix 6°	Price:	30¢/lb.
MANGO	50%	Brix 10°	Price:	25¢/lb.
SOUR SOP	70%	Brix 8°	Price:	30¢/lb.
BANANA	65%	Brix 15°		-
PASSION FRUIT	30%	Brix 10°	Price:	50¢/lb.

MANGO JAM

Pulp from fruit 50%
Brix 10Bx° (sugar in mango 10/100)

X • 10/100 + X • 1 = 550 lbs. • 68/100
1.1 X = 374
X = 340 lb.

USING 340 lbs. Sugar + 340 lbs. Pulp

RAW MATERIALS			
PULP	340 ←--- 680 x 0.25/lb.		170.00
SUGAR	340 lbs. x .64/lb.		217.60
PECTIN	0.4% x 550 ---→ 2.2 lb. x 13.12/lb.		28.86
CITRIC ACID	0.2% x 550 ---→ 1.1 lb. x 7.20/lb.		7.92
		Sub Total	424.38
PACKAGING MATERIAL			
JARS	500 x .486		243.00
CAPS	500 x .1295		64.75
HANDLING	500 x .06		30.00
LABELS	500 x .10		50.00
CARTON	41.6 x .94		39.17
		Sub Total	426.92
UTILITIES			
STEAM (Gas)	2318.00/8 months		14.49
WATER	16.80/2 months		.42
ELECTRICITY	174.00/month		8.70
		Sub Total	23.61
LABOUR			
FLOOR WORKER	17.43 x 7 workers		122.01
(Includes 6.19% vacation + 5% Natl. Insurance)			
DRIVER/MECHANIC	21.00		22.24
SUPERVISOR	31.50		33.36
		Sub Total	177.61
ADMINISTRATION			
MANAGER + TRANSPORTATION + MISCELLANEOUS			226.20
FINANCIAL COSTS (2000.00/month)			100.00
		Sub Total	326.20
		GRAND TOTAL	1378.72
		Price per jar	$2.76

ORANGE MARMALADE

YIELD OF JUICE 42%
JUICE AT 10Bx°
PITH EXTRACT 2Bx°

FORMULA FOR THE MARMALADE
32 lb. Juice + 78 lb. Pith extract + 110 lb. Sugar
Amounts of peel pectin and citric acid are small and are not taken into calculation.

SUGAR BALANCE

$$32 \cdot 10/100 \cdot X + 78 \cdot 2/100X + 110 \cdot X = 550 \cdot 0.68$$
$$3.2 \cdot X + 1.56 \cdot X + 110 \cdot X = 374$$
$$114.76X = 374$$
$$X = 3.259$$

It means that the following quantities of raw materials must be used in order to obtain 550 lb. of marmalade.

JUICE	PITH EXTRACT	SUGAR
104.29	254.2	358.49

RAW MATERIALS			
JUICE	104.29 • 100/42 = 248.3	x 0.30/lb.	74.49
SUGAR	358.49	x 0.64/lb.	229.43
PECTIN	0.5 x 3.259 = 1.63	x 13.12/lb.	21.39
CITRIC		7.20/lb.	
		Sub Total	325.31
PACKAGING MATERIAL			
JARS	500 x .486		243.00
CAPS	500 x .1295		64.75
HANDLING	500 x .06		30.00
LABELS	500 x .10		50.00
CARTON	41.6 x .94		39.17
		Sub Total	426.92
UTILITIES			
STEAM (Gas)	2318.00/8 months		14.49
WATER	16.80/2 months		.42
ELECTRICITY	174.00/month		8.70
		Sub Total	23.61
LABOUR			
FLOOR WORKER	17.43 x 7 workers		122.01
(Includes 6.19% vacation + 5% Natl. Insurance)			
DRIVER/MECHANIC	21.00		22.24
SUPERVISOR	31.50		33.36
		Sub Total	177.61
ADMINISTRATION			
MANAGER + TRANSPORTATION + MISCELLANEOUS			226.20
FINANCIAL COSTS (2000.00/month)			100.00
		Sub Total	326.20
		GRAND TOTAL	1279.65
		Price per jar	$2.56

GUAVA JELLY

1 lb. of clean fruit yields 1.4 lb. of guava juice after cooking with 1.5 lb of water.

JUICE SUGAR
90.6 • 6/100 X + 90 • 1 • X = 550 • 0.68
5.4X + 90X = 374
95.4X = 374
X = 3.92

GUAVA JUICE SUGAR
352.8 + 352.8

RAW MATERIALS			
GUAVA JUICE	352.8/1.4 • 0.9 = 280 x .30/lb.		84.00
SUGAR	352.8 x .64		225.79
PECTIN	0.5 x 3.92 = 1.96 x 13.12/lb.		25.71
CITRIC ACID	100 • 0.45 x 3.92 = 176.4/454 x 7.2		2.79
		Sub Total	338.29
PACKAGING MATERIAL			
JARS	500 x .486		243.00
CAPS	500 x .1295		64.75
HANDLING	500 x .06		30.00
LABELS	500 x .10		50.00
CARTON	41.6 x .94		39.17
		Sub Total	426.92
UTILITIES			
STEAM (Gas)	2318.00/8 months		14.49
WATER	16.80/2 months		.42
ELECTRICITY	174.00/month		8.70
		Sub Total	23.61
LABOUR			
FLOOR WORKER	17.43 x 7 workers		122.01
(Includes 6.19% vacation + 5% Natl. Insurance)			
DRIVER/MECHANIC	21.00		22.24
SUPERVISOR	31.50		33.36
		Sub Total	177.61
ADMINISTRATION			
MANAGER + TRANSPORTATION + MISCELLANEOUS			226.20
FINANCIAL COSTS (2000.00/month)			100.00
		Sub Total	326.20
		GRAND TOTAL	1292.60
		Price per jar	$2.59

GUAVA JAM

Pulp from clean fruit: 85%

PULP SUGAR
44 • 9/100X + 88 • 1 • X = 550 • 0.68
3.96X + 88X = 374
X = 4.067

178.9 + 357.9

RAW MATERIALS			
PULP	178.9 • 1/.9 • .85 - 233.8 .. .30/lb.		70.14
SUGAR	357.9 x .64/lb.		229.06
PECTIN	0.45 x 4.067 - 1.83 x 13.12/lb.		24.01
CITRIC	100 x .45 x 4.067 = 183/454 x 7.2		2.90
		Sub Total	326.11
PACKAGING MATERIAL			
JARS	500 x .486		243.00
CAPS	500 x .1295		64.75
HANDLING	500 x .06		30.00
LABELS	500 x .10		50.00
CARTON	41.6 x .94		39.17
		Sub Total	426.92
UTILITIES			
STEAM (Gas)	2318.00/8 months		14.49
WATER	16.80/2 months		.42
ELECTRICITY	174.00/month		8.70
		Sub Total	23.61
LABOUR			
FLOOR WORKER	17.43 x 7 workers		122.01
(Includes 6.19% vacation + 5% Natl. Insurance)			
DRIVER/MECHANIC	21.00		22.24
SUPERVISOR	31.50		33.36
		Sub Total	177.61
ADMINISTRATION			
MANAGER + TRANSPORTATION + MISCELLANEOUS			226.20
FINANCIAL COSTS (2000.00/month)			100.00
		Sub Total	326.20
		GRAND TOTAL	1280.45
		Price per jar	$2.56

GRAPEFRUIT MARMALADE

Yield 32% pulp (juice sacks) from fruit.
Brix 6Bx°
Pith Brix 0.2Bx°

$32 \bullet 6/100 \bullet X + 78 \bullet 2/100 \bullet X + 110 \bullet X = 550 \bullet 0.68$
$1.92X + 0.16X + 110X = 374$
$112.08X = 374$
$X = 3.337$

PULP PITH EXT. SUGAR
106.78 + 260.28 + 367.07

RAW MATERIALS			
PULP	106.78 • 1/0.32 = 333.68 x .30/lb.		100.10
SUGAR	367.07 x 0.64/lb.		234.92
PECTIN	0.5 x 3.337 = 1.66 x 13.12/lb.		21.89
CITRIC ACID			
		Sub Total	356.91
PACKAGING MATERIAL			
JARS	500 x .486		243.00
CAPS	500 x .1295		64.75
HANDLING	500 x .06		30.00
LABELS	500 x .10		50.00
CARTON	41.6 x .94		39.17
		Sub Total	426.92
UTILITIES			
STEAM (Gas)	2318.00/8 months		14.49
WATER	16.80/2 months		.42
ELECTRICITY	174.00/month		8.70
		Sub Total	23.61
LABOUR			
FLOOR WORKER	17.43 x 7 workers		122.01
(Includes 6.19% vacation + 5% Natl. Insurance)			
DRIVER/MECHANIC	21.00		22.24
SUPERVISOR	31.50		33.36
		Sub Total	177.61
ADMINISTRATION			
MANAGER + TRANSPORTATION + MISCELLANEOUS			226.20
FINANCIAL COSTS (2000.00/month)			100.00
		Sub Total	326.20
		GRAND TOTAL	1311.25
		Price per jar	$2.62

SOUR SOP JAM

Yield 70% from fruit.
Brix 8Bx°

90 • 8/100 • X + 90 = 550 • 0.68
7.2X + 90X = 374
X = 374/97.2 = 3.848

PULP + SUGAR
346.32 + 346.32

RAW MATERIALS			
PULP	346.32 • 1/0.7 = 494.74 x .30/lb.		148.42
SUGAR	346.32 x 0.64		221.64
PECTIN	0.5 x 3.843 = 1.92 x 13.12/lb.		25.19
CITRIC	250 • 3.848 • 0.45 = 432.9/454 x 7.20/lb.		6.87
		Sub Total	402.12
PACKAGING MATERIAL			
JARS	500 x .486		243.00
CAPS	500 x .1295		64.75
HANDLING	500 x .06		30.00
LABELS	500 x .10		50.00
CARTON	41.6 x .94		39.17
		Sub Total	426.92
UTILITIES			
STEAM (Gas)	2318.00/8 months		14.49
WATER	16.80/2 months		.42
ELECTRICITY	174.00/month		8.70
		Sub Total	23.61
LABOUR			
FLOOR WORKER	17.43 x 7 workers		122.01
(Includes 6.19% vacation + 5% Natl. Insurance)			
DRIVER/MECHANIC	21.00		22.24
SUPERVISOR	31.50		33.36
		Sub Total	177.61
ADMINISTRATION			
MANAGER + TRANSPORTATION + MISCELLANEOUS			226.20
FINANCIAL COSTS (2000.00/month)			100.00
		Sub Total	326.20
		GRAND TOTAL	1356.44
		Price per jar	$2.71

PINEAPPLE JAM

Yield of pulp from fruit 60%
Brix of pulp 8Bx°

92 • 8/10 • X + 92 • 100/100 • X = 550.5 • 0.68
7.36X + 92X = 374
99.36X = 347
X = 3.51

PINEAPPLE PULP + SUGAR
321.2 + 321.2

RAW MATERIALS			
PULP	321.2 • 100/60 = 535.3 x 1.75		936.77
SUGAR	321.2 x .64		205.56
PECTIN	0.5 x 3.51 = 1.75 x 13.12		23.02
CITRIC	200 x 3.51 = 702 x 0.45 = 3.15/454 x 7.20		5.00
		Sub Total	1170.35
PACKAGING MATERIAL			
JARS	500 x .486		243.00
CAPS	500 x .1295		64.75
HANDLING	500 x .06		30.00
LABELS	500 x .10		50.00
CARTON	41.6 x .94		39.17
		Sub Total	426.92
UTILITIES			
STEAM (Gas)	2318.00/8 months		14.49
WATER	16.80/2 months		.42
ELECTRICITY	174.00/month		8.70
		Sub Total	23.61
LABOUR			
FLOOR WORKER	17.43 x 7 workers		122.01
(Includes 6.19% vacation + 5% Natl. Insurance)			
DRIVER/MECHANIC	21.00		22.24
SUPERVISOR	31.50		33.36
		Sub Total	177.61
ADMINISTRATION			
MANAGER + TRANSPORTATION + MISCELLANEOUS			226.20
FINANCIAL COSTS (2000.00/month)			100.00
		Sub Total	326.20
		GRAND TOTAL	2124.69
		Price per jar	$4.25

ORANGE MARMALADE - PORTION PACK

Using the calculation made for Orange Marmalade in jars, it should be taken into consideration that only 330 lbs. of product are needed for 10,000 units.

Therefore, cost of raw material will be 195.2 = $\left[\frac{325.31 \times 330}{550} \right]$

Cost of Utilities, Labour and Administration are the same:

Raw Materials		195.2
Packaging Materials 10,000		
Cups	10,000 x 0.04 =	400.00
Lids	10,000 x 0.04 =	400.00
Cartons	50 x 0.51 =	25.50
	Sub Total	825.50
Utilities		23.61
Labour		177.61
Administration		326.20
	Grand Total	1548.12
Price per carton (200 Units)		$ 30.96

GUAVA JELLY - PORTION PACK

Using the calculation made for Guava Jelly in jars, it should be taken into consideration that only 330 lbs. of product are needed for 10,000 units.

Therefore, cost of raw material will be 203 = $\left[\frac{338.29 \times 330}{550} \right]$

Cost of Utilities, Labour and Administration are the same:

Raw Materials			203.00
Packaging Materials 10,000			
Cups	10,000 x 0.04	=	400.00
Lids	10,000 x 0.04	=	400.00
Cartons	50 x 0.51	=	25.50
		Sub Total	825.50
Utilities			23.61
Labour			177.61
Administration			326.20
		Grand Total	1555.92
Price per carton (200 Units)			$ 31.12

PINEAPPLE JAM - PORTION PACK

Using the calculation made for Pineapple Jam in jars, it should be taken into consideration that only 330 lbs. of product are needed for 10,000 units.

Therefore, cost of raw material will be 702.21 = $\left[\frac{1170.35 \times 330}{550}\right]$

Cost of Utilities, Labour and Administration are the same:

Raw Materials		702.21
Packaging Materials 10,000		
Cups	10,000 x 0.04 =	400.00
Lids	10,000 x 0.04 =	400.00
Cartons	50 x 0.51 =	25.50
	Sub Total	825.50
Utilities		23.61
Labour		177.61
Administration		326.20
	Grand Total	2055.13
Price per carton		$ 41.10

GRAPEFRUIT MARMALADE - PORTION PACK

Using the calculation made for Grapefruit Marmalade in jars, it should be taken into consideration that only 330 lbs. of product are needed for 10,000 units.

Therefore, cost of raw materials will be 214.15 = $\left[\frac{356.91 \times 330}{550} \right]$

Cost of Utilities, Labour and Administration are the same.

Raw Materials		214.15
Packaging Materials 10,000		
Cups	10,000 x 0.04 =	400.00
Lids	10,000 x 0.04 =	400.00
Cartons	50 x 0.51 =	25.50
	Sub Total	825.50
Utilities		23.61
Labour		177.61
Administration		326.20
	Grand Total	1567.07
Price per carton		$ 31.34

PEPPER SAUCE

The yield on pepper sauce has large variations from batch to batch. In the calculation, a yield of 48 cases end product from 90 lbs. of pepper was chosen.

RAW MATERIALS						
PEPPERS	90 lbs.	x	1	$/lb.		90.00
ONIONS	44 lbs.	x	0.84	$/lb.		36.96
ACETIC ACID	60 litres	x	1.46	$/lb.	(5 gal. - 276.40)	87.60
SUGAR	2 lb.	x	0.64	$/lb.		1.28
SALT	2 lb.	x	0.40	$/lb.		0.80
MUSTARD	2 gal.	x	10.30	$/lb.		20.60
					Sub Total	237.24
PACKAGING MATERIAL						
BOTTLES)						
CAPS)	1152	x	0.62			714.24
CARTONS)						
LABELS	1152	x	0.1			115.20
					Sub Total	829.44
UTILITIES						
STEAM (Gas)	2318.00/8 months					14.49
WATER	16.80/2 months					.42
ELECTRICITY	174.00/month					8.70
					Sub Total	23.61
LABOUR						
FLOOR WORKER	17.43 x 7 workers					122.01
(Includes 6.19% vacation + 5% Natl. Insurance)						
DRIVER/MECHANIC	21.00					22.24
SUPERVISOR	31.50					33.36
					Sub Total	177.61
ADMINISTRATION						
MANAGER + TRANSPORTATION + MISCELLANEOUS						226.20
FINANCIAL COSTS (2000.00/month)						100.00
					Sub Total	326.20
					GRAND TOTAL	1594.10
					Price per bottle	$1.3837

SUMMARY

A summary of the production costs and sales price and a calculation of the gross profit is given below:

PRODUCT	PRODUCTION COST (Jar)	SALES PRICE (Jar)	PROFIT	%
Orange Marmalade	2.56	3.33	0.77	30
Guava Jam	2.56	3.33	0.77	30
Guava Jelly	2.59	3.33	0.74	28.6
Grapefruit Marmalade	2.62	3.33	0.71	27.1
Sour Sop Jam	2.71	3.50	0.79	29.2
Mango Jam	2.76	2.92	0.16	5.6
*Pineapple Jam	4.25	4.00	-0.25	-
Pineapple Jam (future)	3.98	4.00	0.02	0.5
PORTION PACK				
Orange Marmalade	30.96 (carton)	40.00	9.04	29.2
Guava Jam	31.12 (carton)	40.00	8.88	28.5
Grapefruit Marmalade	31.34 (carton)	40.00	8.66	27.6
Pineapple Jam	41.10	45.00	3.90	9.5
Pepper Sauce in bottle	1.3837	1.50	0.1163	8.4

* The cost of pineapple of the batch analysed was 1.75; however, in the future, pineapple will cost 1.5, reducing the price to 3.98.

ANNEX III

PROGRAMME FOR A COURSE IN PRODUCTION AND QUALITY CONTROL OF JAMS, JELLIES AND MARMALADES

Methodology

The course was conducted inside the plant during working hours. Every class took at least one hour, and classes were held whenever it did not disturb the normal activity of the plant. Of course, the plant lacks any teaching facilities, and using cartons as blackboards and caps as teaching aids, somehow it was managed.

The course included two parts, a theoretical part and a practical one. During the theoretical part, an effort was made to transmit the material to the pupils by active participation and plenty of exercise and repetition.

However, observing this material was difficult for people who had been out of studying practice for a long time.

On the practical side, it was easier, and at least two of the participants had a good knowledge how to operate the equipment.

The topics dealt with are summarized below:

Theoretical Part

1. Units and Measurements

   - American vs. MKS systems
   - Units for length, area, volume, density, weight and temperature

2. Basics of Chemistry

   - Elements, compounds, atoms, molecules, chemical symbols
   - Chemical bonds:

     Ions, cations, amions, metals, non-metals, organic bonds

   - Chemical reactions:

     Equations, balancing chemical equations, atomic and molecular weights, stechiomatric calculation

3. Elements of Food Technology

   Reasons for food spoilage, pH values of foods, basic method of food preservation.

4. Jams, Jellies and Marmalades

   Definitions, production process, yield calculations and quality control.

   - Packaging and labelling
   - Net weight
   - Sensorial analysis
   - Chemical analysis

Practical Part

1. Use, care and maintenance of:

   Semianalytical balance, pipette, burets, volumetric flasks, graduated cylinder, refractometer, pH meter. Safety rules.

2. Titration:

   Titration with indicator, titration with pH meter.

   Calculation of acidity.

ANNEX IV

LIST OF LABORATORY EQUIPMENT AND CHEMICALS

CURTIN MATHESON SCIENTIFIC INC.
HOUSTON, TEXAS 77251
USA

REF: Your quotation No. 008806 dated November 2, 1988

No.	Quantity	Description	Unit Price	Total Price
1.	1	Hand Refractometer Model 62	166.25	166.25
*2.	2	Hand Refractometer Model 82	166.25	232.50
3.	1	Equatherm Stirrer	106.54	106.54
4.A	2	1000cc CMS Cylinder graduated	4.85	9.70
4.B	2	500cc CMS Cylinder graduated	3.92	7.84
5.A	1 Pk.	Cylinder KX Sgl. Grd. 50ml	24.90	24.90
5.B	1 Pk.	Cylinder KX Sgl. Grd. 100ml	29.64	29.64
6.	4	Buret PX Glass 50ml	46.12	184.48
7.A	1 cs.	Beakers PX 50ml	50.43	50.43
7.B	1 cs.	Beakers PX 100ml	53.95	53.95
7.C	1 cs.	Beakers PX 250ml	50.43	50.43
8.A	6	Pipette 50ml	7.28	43.68
8.B	6	Pipette 25ml	4.52	27.12
8.C	6	Pipette 10ml	1.51	9.06
8.D	6	Pipette 1ml	1.39	8.34
*9.	1 Pk.	Stirring Rods	12.83	12.83
10.	1 doz.	Rubber Policemen	16.66	16.66
11.A	1 cs.	Flask Erlenmeyer	60.40	60.40
11.B	1 cs.	Flask Erlenmeyer	62.16	62.16
*12.A	2 Pk.	Flask Vol. PX 100ml	56.81	113.62
12.B	4 Pk.	Flask Vol. PX 1000ml	17.94	71.76
13.	2	Thermometer W/Armour - 20-105 C	15.63	31.26
14.	2	Replacement Thermometer - 20-105 C	7.22	14.44
				1387.99
		INLAND MOTOR FREIGHT		65.00
			TOTAL	1452.99

- Please add magnetic stirrers (Teflon-coated) for No. 3
- The Equatherm stirrer should be for 220 Volts if available
- Please forward to following for Shipping:
  Universal Trading & Engineering Corporation
  2250 NW 93rd. Ave.
  Miami, Florida 33172

FISHER SCIENTIFIC
International Division
50 Fadem Rd.
Springfield, New Jersey 02081
USA

REF: Your quotation C 284 22-8302-501B dated November 8, 1988

NO.	QUANTITY UNIT	DESCRIPTION	PRICE
24A	1 EA	SODIUM HYDROXIDE ACS 500g	15.40
25B	1 EA	PHENOLPHTHALEIN ACS 100g	19.25
26A	1 EA	BUFFER SOLUTION pH 4.0 500ml	9.99
27A	1 EA	BUFFER SOLUTION pH 7.0 500ml	9.99
			54.63
	ESTIMATED INLAND FREIGHT TO MIAMI		30.00
		TOTAL	84.62

- Please forward to the following for Shipping:

UNIVERSAL TRADING & ENGINEERING CORPORATION
2250 NW 93rd. Ave.
Miami, Florida 33172

ANNEX V

EXTENDED DIAGNOSIS

During the first phase of the mission a comprehensive diagnosis of the plant's activities and operation was made and presented (Annex I). However, returning after two months to Saint Lucia, it was a real disappointment to see that the same type of problems were still disturbing the smooth flow of production in the plant.

A table presented at the end of this Annex summarizes the plant's production for the first seven weeks of 1989 (during five of which I was present practically every day at the plant).

After the model of producing 500 16oz. jars per day was presented (Annex II), it was adapted as a target for this year's operations. So far, only in two out of the seven weeks, production was over 62.5% of the capacity, which is more or less the breakeven point.

The same reasons which prevented a smooth flow of the production process during the first phase of the mission are repeating themselves over and over again. It was decided to extend parts of the diagnosis from the first issue in order to pinpoint the problems.

Five major reasons are responsible for the plant's unsatisfactory operation:

- Interruption of the electrical service occurred five times in six weeks of operations.
- Interruption in the water supply; two whole days lost because of this.
- No gas; 4-1/2 days of production lost because gas was not delivered on time.
- No steam; about 2-1/2 days of production lost because of problems with the boiler, especially concerning the water feed pump.
- Lack of raw materials (fruit and sugar). In many of the cases when production was lower than expected, insufficient supply of raw materials was responsible. On top of this, on 14 February, processing was stopped because of lack of sugar.

Each of these points is discussed below in order to try to find a solution for it.

1. Electricity

Very little can be done about the interruption in the electrical service. Maybe it should be considered as some kind of "force majeure".

However, it would be a great help if the company would advise ahead of time that the service will be cut off, and perhaps this should be officially requested.

2. Water

The water supply is another "force majeure" and not much can be done about it in the near future. In the long run, the gutters collecting rain water should

be repaired, and at the beginning of the rainy season the big water tank should be emptied and cleaned, and then rain water should be collected. This water is of very high quality for the boiler and can also be used for processing. The stored rain water in the tank is so contaminated that it cannot be used for processing.

3. Gas

Problems with the supply of gas have been giving a considerable headache for a long time. It takes sometimes a week from the moment the gas is ordered until it is delivered to the plant.

A second storage tank for gas should be installed immediately (the foundations are already prepared) so that while waiting for delivery, the second tank can be used.

It was observed that by putting pressure on the gas company (Shell) it helped to speed up delivery.

4. Steam

The steam boiler is the heart of the plant. Unfortunately, it was not treated properly for a long time and now various problems have come up during the last three months. It is fed with water of bad quality, proper blow down is not done, and the practice of introducing cold water into the red hot boiler probably caused the boiler tubes to crack (see Annex I).

Only proper treatment of the boiler will solve the problem, and supplying it with rain water instead of system water would be a great help.

Another problem is the feed water supply pump, which is falling apart, and even when it works, it has a hard time pumping water into the boiler while the pressure is already built.

A great effort was made to find the proper pump in Saint Lucia, but it was fruitless.

A new pump will have to be purchased in the near future either with UNIDO funds or by the plant's own means.

5. Raw Materials

Having no real storage for raw materials (see Annex I), larger amounts of fresh raw materials should be purchased, even at the risk that some would eventually spoil. This is the only way to assure the achievement of the target production of 500 jars as the equivalent per day.

For the future, the SO_2 preserving method for fruits should be employed in order to build a permanent stock of raw materials.

Sugar - when sugar is not available from government stock, it should be bought even at a higher price from a private warehouse to assure continuous production.

Week	Monday	Tuesday	Wednesday	Thursday	Friday	Total
I 2/1/89	- -	- -	A N N U A L L E A V E -		- -	-
II 9/1/89	No work Salary negotiations	Preparation of raw materials	Orange Marmalade 640	No gas	No gas Stock	Orange Marmalade 640 4 days 32%
III 16/1/89	No gas Preparation	Grapefruit Marmalade 469 Guava Jelly 309	Grapefruit Marmalade 440 14.00 - no electricity	Preparation	Orange Marmalade 460 10.00-14.00 no electricity	Orange Marmalade 460 Guava Jelly 309 Grapefruit 909 67%
IV 23/1/89	Preparation for Pepper Sauce	Pepper Sauce 23 cases Prepare Grapefruit	Grapefruit Marmalade 6560 P.P.	Grapefruit Marmalade 258 16 oz. 474 5 oz.	No gas (delivered 3 p.m.)	Pepper Sauce 23 cases Grapefruit Marmalade 6560 P.P. 258 16 oz. 474 5 oz. 43%
V 30/1/89	Pepper Sauce 32 cases	No water	No water	Grapefruit Marmalade 328 Pump's Gasket	No raw materials	Pepper Sauce 32 cases Grapefruit Marmalade 328 26%
VI 6/2/89	Holiday	Preparation No electricity - 12.00 Holiday	Grapefruit Marmalade 789	Orange Marmalade 4425 P.P. Pump's Gasket	Orange Marmalade 2945 P.P.	Grapefruit Marmalade 789 Orange Marmalade 7370 P.P. 3.5 days 71%
VII 13/2/89	No raw materials	Guava Jelly 305 (frozen guava) No sugar	10.30 sugar Pepper Sauce 18.5 cases	No electricity all day	Guava Jelly 580	Guava Jelly 885 Pepper Sauce 18.5 43%
						6 week average 47%

ANNEX VI

IMPROVED PROCESS PROCEDURES

This Annex brings out the new working procedures to be used when the new equipment (citrus-juicer and blender) is received at the plant.

These procedures apply mainly to orange marmalade, grapefruit marmalade and pepper sauce. Of course, whenever blending is necessary, the process will be made much more efficient, saving time and labour. A detailed reference is given below.

Orange Marmalade

The actual process for the preparation of orange marmalade is long and inefficient and not very hygenic. Each orange is peeled by hand with a knife cutting the rind in a circular form, then it is cut into two pieces and squeezed by hand in order to obtain juice. The leftovers are cooked with water in order to obtain the pith extract.

Later, all ingredients are cooked together for the production of the marmalade.

The rind must be cooked separately in water and cut into strips by hand.

In the new process the orange will be washed, cut in half and extracted by the machine. The pulp which remains after screening the juice, together with some of the peel, will be cooked in water in order to obtain the pith extract.

It will probably be necessary to slightly increase the amount of pectin in the marmalade.

It is expected to obtain a better quality product with the new method. It will also be labour- and time-saving with a better yield of juice from the oranges.

Grapefruit Marmalade

The process for the production of grapefruit marmalade is even more labour demanding than the one for orange marmalade. After hand peeling of the fruit is completed it is cut into four pieces, leaving out the "heart" of the fruit, which contains the seeds.

This is a very laborious process; the pulp is hand-sorted out from the membrane and later pulped by a blender. The membrane and seeds are cooked for obtaining the pith extract.

Only then the processing of the marmalade itself could start.

The new procedure will be equal to the one used for orange with even more savings on labour, time and juice yield.

Pepper Sauce

In the actual process the pepper, after destemming, is cooked until very soft and only then put into the blender for pulping. This process produces a

lower yield from the pepper compared with a process where the peppers, after destemming, are introduced into boiling water for 5 to 7 minutes and pulped in a powerful blender.

Once the new blender is received the process should be changed.

The cooking of all ingredients should be done until the mixture gets to the boiling point.

A better yield from the peppers can be achieved this way.

ANNEX VII

NEW SMALL EQUIPMENT TO SPEED UP PROCESS

c/o Aunt Lucie's Foods Ltd.
P.O. Box 482
Castries, St. Lucia, W.I.

February 2, 1989

Mr. Peter Ryan
Senior Industrial Development Field Advisor
UNIDO
P.O. Box 625C
Bridgetown
Barbados

Dear Peter,

I hope that by this time the "messenger" has delivered my former letter to you.

There are a few more pieces of equipment which are essential for the Plant's operation. Almost all of them can fit into the category of laboratory equipment so we do not have any problem using our budget for purchasing them.

At an early stage of my first phase mission, I have sent out quite a few letters asking for quotations; unfortunately, I received hardly any answers. Therefore, I am not presenting more than one quotation for these items.

However, I consider the prices to be adequate.

I would also like to give the justification for purchasing each one of these items:

1. Citrus Juicer - The Plant does not have any kind of citrus juicer at the moment. When orange or grapefruit marmalade is being processed, the fruit is hand peeled with a knife! then cut into slices and squeezed by hand! It is a very slow and not the most hygenic process.

   Therefore I suggest to purchase a small juice extractor.

   JCC 25 Citrus Extractor - price US$ 420.00

2. Commercial Blender - At the moment small type of blenders are used to crush fruit pulp for jams and peppers for pepper sauce.
   The content of the container is only 1 quart and the motor is rather small (1/3 h.p.). The preparation of raw material is a very long and tedious task.
   Therefore, purchasing a commercial blender will solve the problem.

   240 C.B.6 Commercial Blender (3 H.P.) - price US$ 758.00

3. Scales - Ingredients like sugar, salt, pectin etc. are weighed by a 10 lb. capacity scale.
The scale is very old and I took it down to a shop to be repaired. However, it is not accurate and I suspect that some of the formulation problems are rooted in this scale.

It is very urgent to purchase a new one of better quality. We went all around Castries looking for something better but we could not find one. This week I found one at WITECO with a capacity of 20 lbs. with a superior type of construction. I suggest that this should be purchased locally. Price - EC$ 1,000.00

4. We have a major problem with the Boiler Feed Pump which is at least 30 years old! The original motor on it is gone and a new one was adopted. This pump breaks down very frequently causing a complete stop of all operations.

It is impossible to find this type of Pump on the island. I asked for quotations but got none so far. I will communicate it to you as soon as possible.
It is very urgent.

I am enclosing the quotation for the above pieces of equipment and hope that the purchasing process would not take too long.

With kind personal regards.

Sincerely yours,

(signed)

Yoram Levtov

Enclosure

ANNEX VIII

NEW PRODUCTS

Green Pepper Sauce

Recipe (for a batch)

Green Peppers	-	90	lbs.
Onions	-	44	lbs.
Garlic	-	2	lbs.
Acetic Acid	-	6000	ml.
Sugar	-	2	lbs.
Salt	-	2	lbs.
Mustard	-	2	gallons
Pectin	-	4	oz.
Water	-	120	litres

Process

The preparation of the green pepper sauce follows the same steps as the production of regular pepper sauce.

However, it can also be made by the following method:

The green peppers are blanched for 7 minutes in boiling water. The water is drained and the peppers are blended in a blender with the other ingredients and brought to boiling point and then filled hot.

Note: leaving the blanched peppers overnight in acetic acid improves the quality of the final product.

Rum Orange Marmalade

Recipe (for a batch)

Sugar	-	100	lbs.
Orange juice	-	32	lbs.
Pith extract	-	64	lbs.
Rum (dark)	-	4	lbs.
Orange peel	-	2-1/2	lbs.
*Pectin	-	8-10	oz.
Citric Acid	-	100	ml. (where necessary)

Process

The preparation of this marmalade is identical to the preparation of the regular orange marmalade at the plant.

The addition of the rum to the boiling mixture is done only after the pectin has already been added.

Note: the regular recipe calls for the use of 8 oz. of pectin for a batch; a slightly higher amount might be necessary for the Rum Orange Marmalade in order to achieve the same texture.

Production

In the production of a batch of Rum Orange Marmalade, 4 lbs. of pith extracts are substituted by 4 lbs. of rum. For this calculation the price of rum is considered at $13.27 per litre (9.95 per bottle of .75 litres). Pith extract cost is 0.

Therefore, the additional cost will be the cost of the rum.

The original sugar balance for a day of production of orange marmalade is:

Juice	Pith Extract	Sugar
104.29 lbs.	254.2 lbs.	358.49 lbs.

In the case of Rum Orange Marmalade it will be:

Juice	Rum	Pith Extract	Sugar
104.29 lbs.	14.9 lbs.	239.3 lbs.	358.49 lbs.

The cost of the rum for a day's production will be: $\frac{14.9}{2.2} \times 13.27 = 89.87\$$

Therefore, the total cost will be:

1279.65 + 89.87 = 1369.52 and the price per jar $2.74, which represents a difference of only 18¢ or 7%.

Naturally, buying rum in larger quantities and different packaging will lower the price considerably.

MEMORANDUM

TO: Geoffrey Devaux, Member of the Board
Marie-Celine Lawrence, General Manager

FROM: Yoram Levtov

DATE: February 16, 1989

RE: PACKAGING OF PEANUT BUTTER

On Wednesday, February 15, we carried out an experiment of repackaging Peanut Butter from a 20 kg. bucket into 12 oz. jars.

The following procedure was used:

The Peanut Butter bucket was introduced into a bath of hot water at 60°C (140°F), water reaching up to 3/4 of the height of the bucket. (This was done inside one of the cooking kettles.) The Peanut Butter was stirred occasionally with a stainless steel large spoon.

After 30 minutes the bucket was taken out of the hot water and the content filled into 12 oz. jars by hand using a small measuring cup as the filling instrument. Then the final filling was done with a table spoon.

The major problem was the introduction of air bubbles into the jar; the solution to this problem was found by using a thin stainless steel rod in punch-like movements. Afterwards, the jars were cleaned and capped by hand.

Much care must be taken not to introduce humidity into the Peanut Butter during the repackaging process.

The density of the Peanut Butter is around 0.9; therefore, the net content of a 12 oz. jar is only 11 oz.(312 gr.). The jars were not filled to the brim, so that the product would not touch the top.

The yield was 65 jars to the bucket.

One worker can handle about 5 buckets in one working day, or the crew of 5 could repackage 25 buckets, producing 1625 jars per day.

...2/

REPACKED PEANUT BUTTER

Cost of Production (1 day)			
Raw Material:			
Peanut Butter ($3.35/lb.)	2.30 x 1625	-	3737.50
Packaging Materials:			
Jars 12 oz. (Caps)	0.89 x 1625	-	1462.50
Cartons	1.10 x 135.4	-	148.94
Labels	0.1 x 1625	-	162.50
	Sub Total		$ 1775.94
Utilities			23.61
Labour			177.61
Administration			226.20
Financial			100.00
	Total		$ 6040.86
Price per Jar			$ 3.72

ANNEX IX

REVISED ESTIMATE OF PRODUCTION COSTS

PEPPER SAUCE

Yield 46 cases (24 5oz. bottles each)

Raw Materials					
Peppers	90 lbs.		1	$/lb.	90.00
Onions	44 lbs.		0.84	$/lb.	36.96
Garlic	2 lbs.		3.56	$/lb.	7.12
Acetic Acid	6 lbs.		14.60	$/lb.	87.60
Sugar	2 lbs.		0.64	$/lb.	1.28
Salt	2 lbs.		0.40	$/lb.	0.80
Mustard	2 gal.		10.30	$/gal.	20.60
Pectin	4 oz.		13.12	$/lb.	3.28
				Sub Total	247.64
Packaging Materials					
Bottles, caps, cartons	1104	x	0.62		684.48
Labels	1104	x	0.1		110.40
Visksrings	1104	x	0.02		22.08
				Sub Total	816.96
Utilities					
Steam					14.49
Water					0.42
Electricity					8.70
				Sub Total	23.61
Labour					
Floor Workers					122.01
Driver/Mechanic					22.28
Supervisor					33.76
				Sub Total	177.61
Administration					226.20
Financial					100.00
				Sub Total	326.20
				Grand Total	1592.02

Price per bottle 1.442 ($34.61 per case).

MANGO CHUTNEY

1 day of production yields 43 cases of 12 oz. jars, each containing 12 jars (516 jars per day).

Raw Materials					
Mango (fruit)	417.5	lbs.	x	0.25 $/lb.	104.38
Onions	60.	lbs.	x	0.84 $/lb.	50.40
Sugar	75.	lbs.	x	0.64 $/lb.	48.00
Salt	10.	lbs.	x	0.40 $/lb.	4.00
Acetic Acid	1.75	Lit.	x	14.60 $/lb.	25.55
Cinnamon	0.625	lbs.	x	22.00 $/lb.	14.30
All Spice	0.625	lbs.	x	22.00 $/lb.	14.30
White Pepper	0.625	lbs.	x	300.00 $/lb.	18.75
Sweet Pepper	5.0	lbs.	x	2.00 $/lb.	10.00
Garlic	1.25	lbs.	x	3.56 $/lb.	4.45
				Sub Total	294.13
Packaging Materials					
Jars 12 oz. (caps)	516	x	0.89$		459.24
Cartons	43	x	1.10$		47.30
Labels	516	x	0.1 $		51.60
				Sub Total	558.14
Utilities					
Steam					14.49
Water					.42
Electricity					8.70
				Sub Total	23.61
Labour					
Floor Worker					122.01
Driver/Mechanic					22.24
Supervisor					33.36
				Sub Total	177.61
Administration					226.20
Financial					100.00
				Sub Total	326.20
				Grand Total	1379.29

Price per jar $2.67

SUMMARY

From 1 February 1989, prices of all marmalades in 16 oz. jars were set at EC$40.00 per case of 12. In other words, the price of Sour Sop Jam was lowered, and that of Mango Jam was raised.

Pepper Sauce price was set at $48.00 per case of 24 5 oz. bottles, and Mango Chutney remained at $42.00 per case of 12 jars each containing 12 ozs.

Product	Production Cost	Cost (Jar)	Sale Price (Jar)	Gross Profit	%
Orange Marmalade	2.56	3.33		0.77	30
Guava Jam	2.56	3.33		0.77	30
Guava Jelly	2.59	3.33		0.74	28.6
Grapefruit Marmalade	2.62	3.33		0.71	27.1
Sour Sop Jam	2.71	3.33		0.62	22.9
Mango Jam	2.76	3.33		0.57	20.6
Pineapple Jam*	3.98	4.00		0.22	0.5
Portion Pack	Per Carton				
Orange Marmalade	30.96	40.00		9.04	29.2
Guava Jam	31.12	40.00		8.88	28.5
Grapefruit Marmalade	31.34	40.00		8.66	27.6
Pineapple Jam	41.40	45.00		3.90	9.5
Pepper Sauce	1.44		2.00	0.56	38.9
Mango Chutney	2.67		3.50	0.83	31.1

*With a new price for Pineapple.

ANNEX V

QUALITY CONTROL SCHEME FOR JAMS, JELLIES AND MARMALADES

The quality control scheme for any industrial product includes three stages: raw materials, process and final product. Checking the quality of the product at each one of these stages is absolutely necessary in order to assure the quality of the final products. At each one of these stages, physical, chemical and sensorial checks are being performed so that requirements for the final product will be met.

Following is a detailed description of a complete quality control scheme for jams, jellies and marmalades. With small variations, this scheme can also be applied to pepper sauce and similar products.

Raw Materials

In the production of jams, jellies and marmalades checking the quality of its raw material, basically the fruit to be used, cannot be over-stressed.

There is no way of obtaining a good quality product if the proper raw materials are not used.

Under the existing circumstances, raw materials which are not fruit cannot be analysed because of the lack of proper facility. Therefore, sugar, pectin, citric acid, mustard, etc., will not be analysed. However, a visual check should be made and any appearance of behaviour of these products differing from the normal should be observed and investigated.

As for the fruit, the following parameters should be checked for each one:

- percentage of cull fruits (which cannot be used)
- general appearance of the fruit, size, blemishes, appearance of the peel (smooth or with wrinkles), fly and insect penetration signs, bird bites, cleanliness, mold (especially blue mold).
- colour
- flavour (watch for off-flavour and fermentation flavour)
- taste
- juice content
- brix
- acid
- pH

If any of these parameters differs considerably from the normal, a further evaluation must be made before this fruit goes into the production process.

All this data should be recorded so that with time it would be very easy for the plant personnel to evaluate the incoming raw material.

Process

- weight and volume of ingredients
- acid, pH of the mixture for determining how much citric acid should be added to the batch
- Brix to determine the cooking end point
- time of cooking in order not to over-cook or under-cook the batch
- colour of the product should also be observed during the cooking

Final Product

Checking the final product is done by steps. First without opening the jar, and then checking the content after it was opened.

The following checks should be carried out:

- net weight
- proper closing of lid by trying to twist it open
- cleanliness of the jar and lid by looking at the jar and turning it around
- label - is label properly applied to the jar; label should be completely horizontal and parallel to the base-line of the jar. Check if ends of the label are properly glued to the jar.
- appearance of the products through the glass; look for seeds, foam, trapped air, bubbles or any other impurities. Look for liquid separation on top.
- colour of the product through the glass.

Once these checks are completed, the jar should be opened and the analysis proceed. While opening, try to observe if the jar had vacuum in it.

Before touching the content, look for mold on the top of the product or on the lid; observe if there is liquid separation (synerisis).

Next should come the sensorial analysis of odour, flavour and taste of the product. Also note mouth feel of the product and formation of sugar crystals in it.

Texture - scoop a teaspoon full of marmalade and put on a smooth surface (glass plate); observe if the product collapses. Try spreading the product with a knife. Its spreadability should be such that it will spread easily with one stroke. Look for trapped air bubbles. In citrus marmalades, observe if rind is equally distributed throughout the height of the jar.

Prepare a sample for chemical analysis according to the procedure which follows. Check:

- Brix
- Acid (calculated as anhyrus citric acid)
- pH

Record all results on the proper form.

Jams, Jellies and Marmalades

The manufacture of jams, jellies is one of the oldest and most important of the fruit industries and affords a means of utilizing a large amount of sound cull fruit unsuited to other purposes.

Definitions

The definitions given below conform to the usual conceptions of the products in question.

- Jam. Jam is prepared by boiling the whole fruit pulp with sugar (sucrose) to a moderately thick consistency without retaining the shape of the fruit. The United States Government pure food regulations require the use of not less than 45 lbs. of fruit to each 55 lbs. of sugar. In the United Kingdom a jam is usually to consist of fruit pulp cooked with sugar to a jelly consistency.

- Jelly. Jelly is prepared by boiling fruit with or without water, expressing and straining the juice, adding sugar (sucrose), and concentrating to such consistency that gelatinization takes place on cooling. A perfect jelly is clear, sparkling, transparent and of attractive colour. When removed from the glass, it should retain its form and should quiver, not flow. It should not be syrupy, sticky or gummy and should retain the flavour and aroma of the original fruit. When cut, it should be tender and yet so firm that a sharp edge and smooth, sparkling cut surface remain.

- Marmalade. A true fruit marmalade is a clear jelly in which are suspended slices of fruit or peel. Frequently jams are mislabeled as marmalades.

Constituents

Three substances are essential to the preparation of a fruit jelly, jams and marmalades. These are pectin, acid and sugar. Of these, pectin is the most important.

- Pectin. It is possible to make a jelly of excellent consistency by combining pectin, acid, sugar and distilled water in the proper proportions. Fruit juices which are normally deficient in pectin or acid, or both, will make good jelly if these constituents are added.

- Acid. Acid is a necessary constituent of fruit jellies. Juices which are deficient in acidity will make good jelly if citric, tartaric or other suitable acid is added, provided the proper proportions of pectin and sugar are present.

- Sugar. Sugar, the third necessary constituent of fruit jellies, may be in the form of any readily soluble sugar, such as cane sugar, dextrose, levulose, maltose, etc. Jelly forms when the concentration of the water-sugar-acid-pectin mixture attains a certain minimum value, which is dependent within limits on the proportions of pectin, acid and sugar.

ACID ANALYSIS AT PLANT LEVEL

1. Preparation of Sample

1.1 Fruit Juices

Filter juice through absorbent cotton placed in a glass funnel.

1.2 Jams, Jellies and Marmalades

Weigh exactly (to 0.1 gr.) a sample of about 10 gr., record weight, transfer to an erelenmeyer flask (125 ml.), add about 25 ml. of distilled water and dissolve with the help of a glass rod until sample is completely dissolved.

2. Determination by Indicator Method

2.1 Fruit Juices

Take 10 ml. of filtered juice with a pipette and transfer about 25 ml. of distilled water and three drops of phenolphtalein (1% in alcohol). Filtrate with 0.1 N Na OH (Sodium Hydroxide) from a buret, shaking the flask continuously, until the appearance of the first change of colour from clear to violet. Record reading.

2.2 Jams, Jellies and Marmalades

Add three drops of phenolphtalein to the prepared sample inside the erelenmeyer flask and continue as in 2.1.

3. Determination by Glass Electrode Method (pH Meter)

In cases where the colour of the juice or dissolved product in water is dark or red, the exact point of the change in colour cannot be determined; therefore, the analysis is performed with a pH Meter, the end point is at pH 8,3.

3.1 Fruit Juices

Transfer the sample by pipette (10 ml.) to a glass beaker of 100 ml., add about 25 ml. of distilled water. Insert the glass electrode into the beaker and titrate with NaOH 0.1 N until reaching pH 8,3. Record reading.

3.2 Jams, Jellies and Marmalades

Dissolve the 10 gr. sample with about 25 ml. of distilled water; once completely dissolved, continue as in 3.1.

For scientific determinations, use AOAC (14th edition) methods No. 22.008 for preparation of sample, and 22.058, 22.059 for determinations.

4. Calculation

1 ml. of 0.1N is equivalent to 0.0064 gr. of citric acid (juices, jams, jellies and marmalades).

1 ml. of 0.1N NaOH is equivalent to 0.006 gr. of acetic acid (pepper sauce).

4.1 Fruit Juices

If A ml. of NaOH 0.1N were used to titrate 10 ml. of juice then:
Acidity gr/100 ml. = A x 100/10 x 0.0064 = A x .064

Example: 16 ml. of NaOH 0.1N were used:
Acidity = 16 x .064 = 1.02 gr./100 ml.

4.2 Jams, Jellies and Marmalades

If B ml. of NaOH 0.1N were used to titrate C gr. of product:
Acidity % = A/B x 100 x 0.0064

Example: 9.4 ml. of NaOH 0.1N were used to titrate 10.7 gr. of marmalade:
Acidity = 9.4/10.7 x .0064 x 100 = 0.56%

4.3 Pepper Sauce

Using 10 ml. of filtrate for the analysis.
If D ml. of NaOH 0.1N were used:
Acidity gr./100 ml. = D x 100/10 x .006 = D x .06

Example: 72.4 ml. of NaOH 0.1N were used.
Acidity: gr./100 ml. = 72.4 x 0.06 = 4.63 gr./100 ml.