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COOK ISLANDS

Technical Report: Assistance to the Mangaia Fruit Dehydration Plant *

Prepared for the Government of the Cook Islands

by the United Nations Industrial Development Organization,

acting as executing agency for the United Nations Development Programme

Based on the work of E. Kissmeyer-Nielsen
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United Nations Industrial Development Organization

Vienna

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I SUMMARY

A. Background

The present project is the outcome of recommendations for recommissioning of the Mangaia Fruit Dehydration Plant arrived at during the expert's appraisal mission during May-June, 1985 and described in his final report of June 12, 1985.

The former Grieco Foods (Cook Islands) Ltd., Mangaia Island has been combined with the Cook Islands Government owned Kia Orana Foods Corporation Ltd., Rarotonga, Cook Islands with main office in Rarotonga, Cook Islands.

The Cook Islands Government signed an agreement with the Waterwide Development Company, New zealand to recommission the Mangaia Plant to replace the propane gas heat source for the dehydration tunnel(s) and the electric heating elements for the hot water blancher with heat from a special wood burner. They also provided a new continuous stainless steel hot water blancher, insulated one of the two dehydration tunnels and were to render the entire plant operational on a turn key basis. About NZ$200,000 were provided as a grant for this by the New Zealand Government.

A timetable was agreed on for this recommissioning and is included in the expert's final report on his May-June, 1985 appraisal mission. This timetable has mostly been adhered to.

Mr Michael E. Benns is now managing director of both Kia Orana Foods Corporation Ltd plants.

The urgent need to find outlet for the pineapples produced by the Mangaia Island Growers is the factor which has had an overall significance in deciding to recommission the plant. Mangaia is very suitable for production of pineapples, but it is very difficult to market fresh pineapples from Mangaia because transport by sea is difficult. There is no all weather deep harbour and transport by air to the New Zealand market is prohibitively expensive.

B. Purpose and Scope

The purpose of the project is to assist the Cook Islands Government to recommission the Kia Orana Foods Corporation Ltd Mangaia Fruit Dehydration Plant. The major motivation for the recondition is to provide a reliable outlet for pineapple production and thus to create a cash income for the growers.

The protracted failure to start the plant up has frustrated the growers, who find it hard to export the pineapples

fresh, due to the rather unreliable and costly shipping situation.

Initially the recommissioning of the plant was done by processing unsweetened pineapples, which can be done without having to wait for the sliced pineapples soaking for one week in 45 - 65° Brix sucrose solution. This made it possible to do a very fast trial run of the plant to find out if there was a need for improvements or repairs of its various functions.

There is, however, still an interest in expanding the processing into other fruit crops such as papaya and mango and possibly also into chili pepper and coffee provided sufficient quantities can be produced. Chili pepper grows well on Mangaia and at present the world market price is favourable. Dried chili pepper and coffee are quite stable in storage and far more so than dehydrated fruit products. This makes the shipping of the products far less critical.

An important underlying reason to create dependable outlets for cash crops for the Mangaia growers is to make it more attractive for the young Mangaians to remain in Mangaia rather than migrating to New Zealand, which has been taking place to a great degree for a number of years. The young Mangaians increasingly feel a need for buying modern things such as video sets and other electronics plus obtain other modern conveniences.

C. Conclusions

The Mangaia Fruit Dehydration Plant was recommissioned mid December, 1985. This was in line with the time schedule agreed on in June/85 during the expert's plant appraisal mission to the Cook Islands. The recommissioning was done under a turn-key contract with the Waterwide Development Corporation of New Zealand. The contract involved among others the replacement of the propane gas burner as a source for hot air for the tunnel dehydrator with a heat exchanger heated by exhaust from a new Waterwide wood burner, improved insulation of one of the two drying tunnels, delivery of a new continuous stainless steel hot water blancher likewise indirectly heated by the exhaust gas from the Waterwide wood burner and various other alterations and improvements to the plant. The new hot water blancher replaced an electrically heated batch type hot water blancher, which it was found consumed more electricity than could be provided by the two new diesel powered electric generators and thus was a major bottle neck in the plant operation.

The McKay Electric Company, Rarotonga, Cook Islands were contracted to do the entire rewiring of the plant and replace various electric motors which were found not to be operative on the Mangaia electric supply system since they were made for the US electric supply system which is different. Various other work were carried out among which

some work on the Ginaca pineapple peeling and coring machine.

Initially one ton of fresh, three quarter ripe pineapple were put through the entire processing system. In order to speed up the testing of the equipment and be ready for the peak season, the sliced pineapples were dehydrated right after being blanched and not put through the sucrose solution dip, which takes at least 7 days.

This initial test showed that the basic functions of the plant now was in order, but it did, however, reveal some malfunctions. The most serious among these is the malfunctioning of the Ginaca peeling and coring machine resulting in excessive loss of sound pineapple flesh. The devise that is supposed to cut the tops and bottoms of the pineapple cylinders does not function, the chain which guides the pineapple cylinders into the rotating drum with multiple cylinders to position the pineapple cylinder for the cutting of tops and bottoms appears partly warped with the result, that many pineapple cylinders get totally smashed in the process. The intial problem of the pineapple sizing knife assembly constantly coming loose was solved by applying plastic steel to the threed prior to tightening.

It is obviously necessary to subject the entire pineapple peeling, coring, grading, trimming and slicing line to

rebuilding or replace the line with a smaller more efficient line, which are available for instance from Italy (*) and of a more manual type from India.

There is a need to procure a small set-up for juice production from the eradicator and trim flesh and cores to make profitable use of these products.

Heavy rains revealed, that the tin roof is leaking a great deal and is in need of resealing.

The cement floor in the processing room has not been treated against the deteriorating effect of the acidic fluids from the pineapple processing.

Although there are needs of various improvements and additions the overall picture is that the plant is now finally functioning and serves as an outlet for the local growers' pineapples.

The various needed improvements and additions may be taken care of before the July-August, 1986 season.

(*) For example from

S.A. Betuzzi

20047 Brugerio (Milano) italia

D. Recommendations

The recommendations presented here are aimed at improving

the efficiency of the processing and increasing the yield of saleable product at the least possible capital outlay.

Although the expert closely followed his terms of reference including the food technology training aspects, his recommendations include 2 months of inplant training of the plant manager, since the manager has not previously been exposed to dehydration of fruit or other food products. It would thus be highly beneficial for the manager to undergo inplant training at a commercially successful pineapple processing plant and fruit dehydration plant to more closely become familiar with commercially acceptable processing procedures. The following are his recommendations:

1. Two months inplant training for the Mangaia Fruit Dehydration plant manager in pineapple processing and fruit dehydration. It is suggested to allow one month for each in commercially successful processing plants in Australia. It is suggested to contact the Australian Fruit and Vegetable Growers Processing Plant near Brisbane which already has provided field training programs for the Mangaia pineapple extension expert and the agricultural officer. If they do not carry out pineapple and/or other fruit dehydration they may be able to refer to another plant.

2. Rebuilding or replacement of the entire pineapple peeling, coring, trimming, grading and slicing line.

If rebuilding all worn and suspect parts must be replaced. If replacing the line, it should be replaced by a smaller capacity more efficient line possibly demanding more manual work.

3. Procurement of a compact and efficient fruit juice line capable of producing sound, single strength pineapple and/or other fruit juice from sound by-products. The pineapple cores, eradicator meat, sound trimmings are suitable for juice production. A small plate pasteurizer could be operated from the hot water blanch tank by recirculating 90 - 95°C hot water through it and thus be able to produce a hot pack, which is preferable to preservation by chemical preservatives.

4. An overhead hoist should be installed over the hot water blancher to be able to easily lift out the stainless steel conveyor, to be able to clean the inside of the blanch tank. Most of the materials are already in the plant including an electric hoist.

5. The cement floor in the processing room must be sealed with an acid resistant paint to prevent the floor from deteriorating from exposure to the highly corrosive acid pineapple drippings.

6. The increasingly leaky plant tin roof must be sealed to arrest the deterioration. There are special sealing

compounds on the market for this use. Larger holes must first be covered by means of pieces of tin and cold sauter.

7. A modest laboratory set-up should be provided to be able to carry out basic tests in the plant such as measuring solids percent, acid content and possibly sulphur dioxide. The procedures for carrying out these tests are already in the plant files.

8. The Waterwide Wood Burner and the drying tunnel temperature controls should be rendered fully operative. The McKay Electric Company in Rarotonga is aware of the need to carry out certain repairs and alterations. More explicit operation instructions for these should also be provided from the Waterwide Development Company in New Zealand.

9. The water supply situation needs to be reviewed by the Kia Orana Foods Corporation Ltd and the Public Works Department. One of the two 10,000 gallon tanks in the back of the plant is not effectively hooked up to the rain water supply. The Public Works Department appears to have a lot of problems with their present diesel powered bore hole pumps. They need to implement the procurement of the two new diesel powered bore hole pumps as agreed during meetings in June of 1985.

10. A more adequate stock of materials and spare parts must be built up at the plant to avoid lengthy break down periods. There is a need of more adequate cleaning utensils and materials.

11. There is a need to construct a small fumigation chamber to treat the dehydrated fruit against insect infestation using such chemicals as methyl bromide. Such a chamber could be 2.5m x 2.5m x 3m high, gas tight and with gas tight sealed doors. The fruit could be gassed in heavy plastic tubs with loose lids used for swetting the fruit (equalizing the moisture content) as well as for occasional gassing against insect infestation. A suggested size is 0.75m x 0.75m x 0.75m deep or 422 litre capacity.

12. A strict rodent control program must be maintained at the plant. This involves placing poison and keep the plant free from organic waste. Also the Mangaia Island as a whole should institute a rodent control program for which the appropriate authorities such as the health authorities should be contacted. Rats are known to be implemental in the spread of numerable serious diseases.

13. Information on the export market for dehydrated pineapple products has not been covered ir great

detail. Since the original plans called for production of dehydrated papaya as well, this product should also be covered. This might have been incorporated into the expert's terms of reference, since his projects commonly also covers investigation of the domestic and world market for the concerned products. UNCTAD/GATT commonly called the International Trade Center (ITC) collects trade statistics on a wide spectrum of food and other agro industry product including dehydrated food products. European Economic Community (EEC) in Brussels likewise collects such trade information for EEC, which imports large quantities of dehydrated fruit and vegetable products. Japan also is a significant importer of such products and have computerized information on its imports, which may be obtained through its Embassies. Although Australia is a major grower and processor of pineapples it may be worthwhile investigating, if it is an importer of dehydrated pineapples. New Zealand has already been covered by the Managing Director of Kia Orana Foods Corporation Ltd and he has likewise made some contacts in USA but not collected in depth information of the US imports of dehydrated pineapples.

14. There is a need for a refrigerated storage room for the finished dehydrated fruits capable of holding the

at 45-50°F in case they are not exported soon their production. The recommendation for the ssioning of the plant called for making a cool room such as 6 x 6m by partitioning off the 15.0 x 14.6m original cool room. This will more economical to operate than the large cool

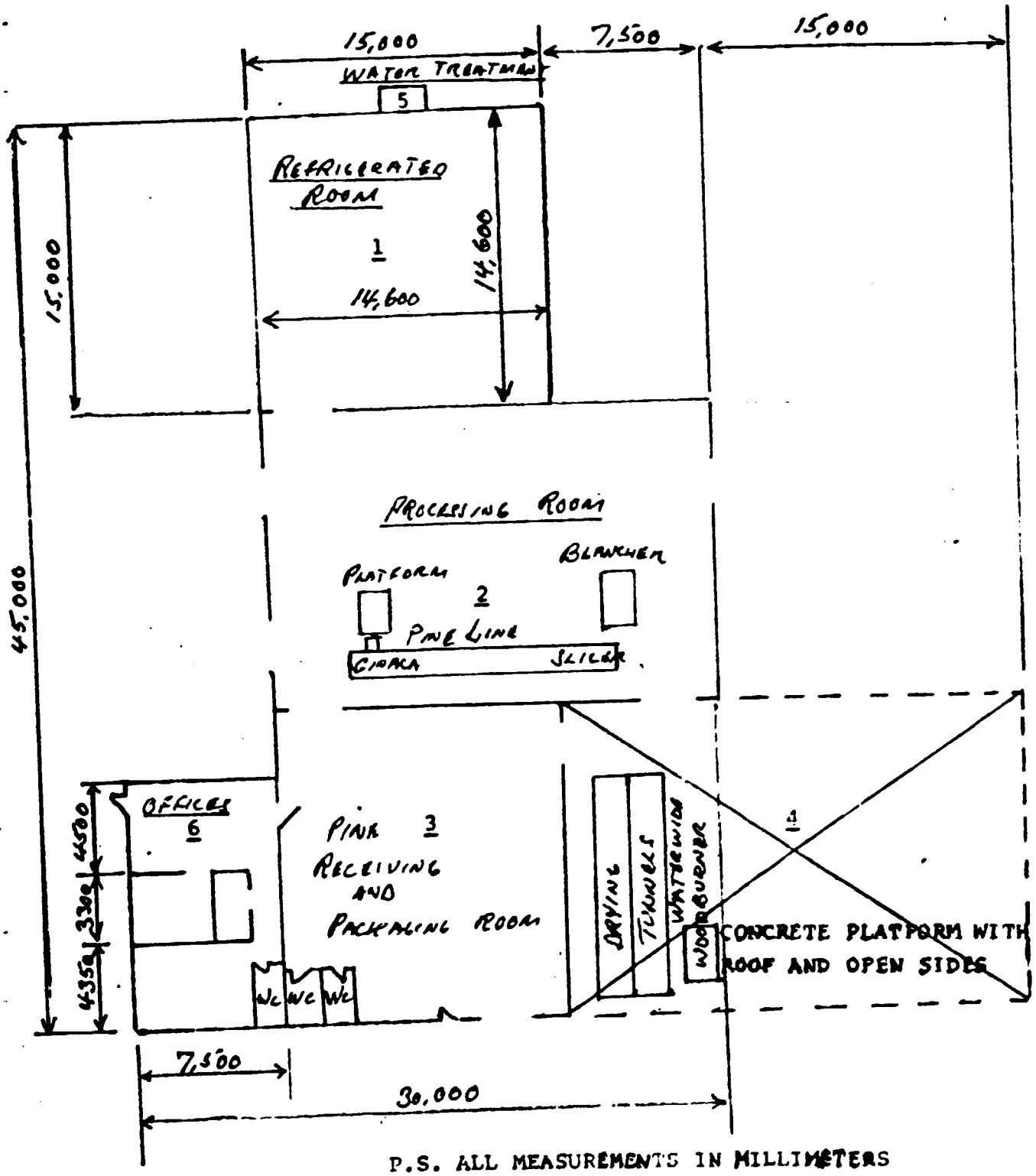
II PRESENT SITUATION

A. Recommissioning

The recommissioning took place mostly according to the schedule agreed on during the expert's May/June, 1985 Mangaia Fruit Dehydration Plant appraisal mission at which time a group of interested parties consisting of Cook Island Government officials, UN and bilateral volunteers plus a Waterwide Development Company, New Zealand representative met. Figure 1 shows the present factory layout. It includes a new Waterwide Wood burner and continuous stainless steel hot water blanching tank heated by passing the hot exhaust gas from the Wood burner through stainless steel tubes at the bottom and sides of the blancher. One of the two drying tunnels was insulated and equipped with a stainless steel heat exchanger using the exhaust gas from the wood burner as heat source. The dryer tunnel is insulated and likewise are the hot air ducts plus the hot water blancher.

The pineapple production season was one month late from mid November to mid December. It was, however possible to procure one ton of 3/4 mature (13 - 19° Brix) pineapples for a December 5/85 test run. The pineapples were peeled and cored on the HONIRON Ginaca and sliced (3/8" thick) on the HONIRON single knife slicing machine, the slices passed through the 90°C hot water blancher for three minutes and

FIGURE 1. FLOOR PLAN FOR THE MANGAIA FRUIT DEHYDRATION FACTORY.



P.S. ALL MEASUREMENTS IN MILLIMETERS

were cooled in cold water (about 25°C - 30°C) before being loaded onto the 3' x 6' slatted wooden drying trays. 400 gram Metabisulfite and 100 gram Sorbate was added to the blanch as well as the cooling water to preserve the colour and help prevent insect and mould infestation.

The reason for initially processing unsweetened pineapple slices was to speed up the testing of the equipment.

The planned sucrose sugar solution soak of the slices takes about seven days, which would have caused an unfortunate delay of the essential testing of the plant equipment. The findings of the intial test showed some weakness in the function of some of the equipment. Particularly the HONIRON Ginaca peeling and coring machine did not function satisfactorily, but suffered frequent breakdowns. The sizing knife assembly came loose numberable times apparently caused by the threads being worn. This has been temporarily mended by applying plastic steel hardener to the threads before re-tightening. Also the feeder and eradicator belts causes frequent trouble by steel parts coming loose or bending. The eradicator feeder belt appears to have softened through frequent bending and to need replacement.

Replacement of worn parts rather than their repair is called for, i.e. a thorough rebuilding job, which unfortunately is expensive, but probably cheaper than suffering continued excessive losses of sound pineapple flesh.

The heterogeneous nature of the pineapple supply caused by the small scale growers and varying cultural practices also poses as a problem in the operation of the Ginaca, which depend on a very homogenious size of pineapple to function most effectively.

The total yield of dehydrated pineapple from the first ton processed was 50kg or a ratio of 1:20 finished versus raw product. A more exact ratio can only be obtained after a considerable amount of pineapple has been processed which using 7 day sugar dip method will take a while. The former Grieco Foods (Cook Islands) Ltd operators of the plant in their economic prognosis for the plant gives a 1:10 ratio finished dehydrated versus raw product, which appears overly optimistic.

The initially low yield of finished dehydrated pineapple products emphasizes the need of utilizing the by products by at least producing juice from sound flesh waste.

B. Present Situation

B, 1 Processing Technology

Consequent operation of the plant is for the production of sucrose sugar sweetened dehydrated pineapples. The flow sheet for this processing procedure is shown in figure 2.

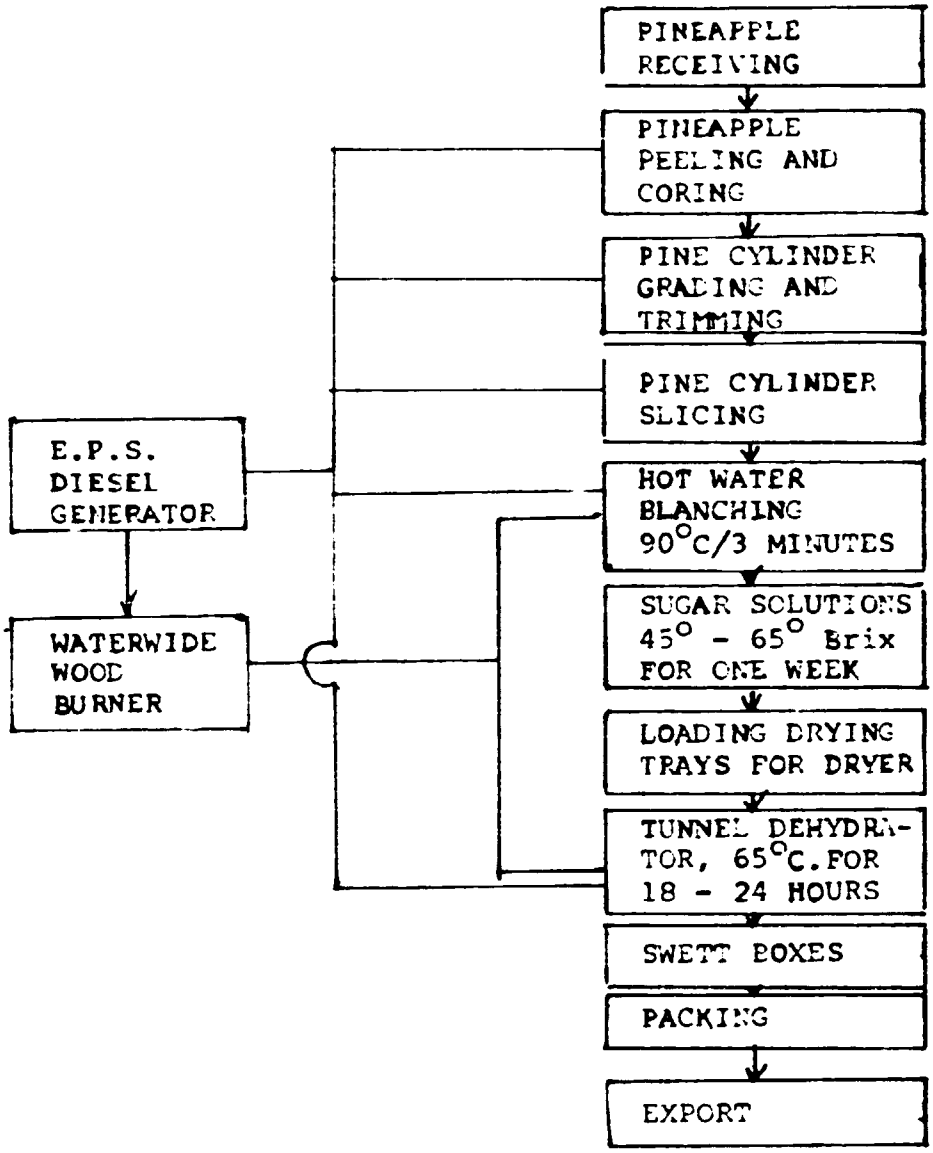
The sliced and blanched pineapples are kept in a sucrose sugar solution for one week, bringing the sugar solution up from 45° to 65° Brix gradually during this period. The sugared slices and pieces are then spread on the 6' x 3' slatted wooden tays at about 2lbs per square foot, the trays are loaded on carts and pushed into the drying tunnel where they are dried for 18-24 hours at 65°C to 14-18% moisture content. They are then removed from the trays and placed into plastic swett bins where they are kept until packed for shipment.

To help preserve them colourwise and prevent insect and mold infestation sorbate and metabisulfite is added to the blanch water as well as the sugar soak solutions at the rates of 100 and 400 ppm and 50 and 1000 ppm respectively.

B, 2 Quality Control

The pineapples are graded manually for size, maturity and defects in the field prior to being

FIGURE 2. FLOW SHEET FOR PINEAPPLE PROCESSING AND DEHYDRATION



P.S. The Waterwide Wood Burner delivers all the heat to operate the hot water blancher as well as the heated athmospheric air tunnel dryer. The EPS Diesel Generator delivers electricity to drive all the electric motors in the plant. Propane gas is only used to heat the water in the detergent steam cleaner and as fuel for the Fork Truck (i.e. propane gas smells less than gasoline as far as the exhaust is concerned).

taken to the factory. At the factory they are tested for °Brix reading by use of handrefractometers.

The former owner/operator, the Grieco Foods Limited only left little laboratory equipment among which is various glassware and laboratory scales plus two handrefractometers. There is at present not an actual laboratory facility in the plant. The Kia Orana Foods Corporation Ltd in Rarotonga sends samples for testing to a New Zealand Laboratory which can provide all common laboratory tests such as testing for SO_2, moisture, microbiological, insecticides etc.

There is, however, a need at the Mangaia plant to be able to carry out certain basic tests such as moisture and SO_2 contents and possibly also the acid content of the raw fruits.

B,3 Sanitation

Mangaia does not have ample pottable water but it is necessary to collect run off rain water from the factory roof. There are two 10,000 'gallon concrete water tanks (stave) in the back of the building for collection of rain water. This water is to be used mainly for cleaning purposes. There is an ultraviolet light purifier with a water

pressure pump to purify the water before it enters the factory. There is also bore hole water supply with diesel powered pumps available but in rather limited quantities and shared with the general water supply needs of the population of Mangaia.

The bore hole water supply is influenced by the precipitation, which varies a great deal in Mangaia from year to year.

The plant has a detergent steam cleaner which provides an effective way to clean machines, drying trays, floors, walls, containers, etc. It operates on propane gas which unfortunately occasionally runs out rendering the machine unoperative. This brings out the need to keep stocks of materials and spare parts, which at the moment are very minimal. There is a need for more cleaning tools such as brooms, brushes, scrapers, shovels, forks, etc. It would make cleaning easier if there was a more adequate number of heavy duty plastic (or other suitable material) bins of about 1000 litre capacity to collect and discharge waste in.

The apparent presence of rodents (rats) calls for a persistant rodent eradication program inside and

outside the plant. Food products infested with rodent droppings and hairs is considered unacceptable by food and drug authorities in most countries and not least USA takes a very dim view at this. Such findings commonly cause the product to be rejected which is very expensive experience and not least if this takes place for products imported into a faraway foreign country.

Also insect control in the plant and for raw as well as finished product needs to be addressed very severely by adequate cleaning, use of insecticides and provision of a fumigation chamber for the finished product (methyl bromide gas is commonly used in fumigation of dehydrated fruit).

In USA the scare caused by finding fruit flies in California and other states a few years back has caused the authorities to be very severe in their inspection of such as imported dehydrated fruit products.

It is important to impose a constant and severe sanitation program at the Mangaia Fruit Dehydration plant. The plant and equipment must be totally cleaned for residual pieces of fruit and other organic matter after each run.

Toilets and wash rooms must be kept clean and supplied with cleaning agents, soap, toilet paper and clean towels.

B,4 Maintenance

The manager of the Mangaia Fruit Dehydration Plant does wonders in keeping the plant operating on a very moderate budget. There is, however, a need to increase the stock of spare parts and materials. This does not least apply to the HONIRON Ginaca peeling and coring machine and the HONIRON Single Knife Slicing machine. Both have given considerable problems during this season and have caused extensive breakdowns and wastage. The Ginaca peeling and coring machine is in need of being rebuilt, i.e. replacement of worn and suspect parts. Among the greatest need of replacement are the eradicator and feed chains which have been bent and unbent so many times, that the metal has become soft. Also the entire sizing knife head needs replacement since the threads appear to be worn out. Commercial pineapple processors carry out a preventive maintenance program on Ginacas by which all suspect parts are replaced at certain intervals of usage. Wher commercial pineapple processing is

common. rebuilding of Ginacas is often carried out by precision machine shops. It is unfortunate, that this is rather expensive caused by expensive parts and labour, but excesive waste of sound pineapple flesh is likewise very expensive and in the case of the situation at the Mangaia plant appears to exceed by far the cost of rehabilitation of the Ginaca or possibly introduction of a more manual peeling and coring method.

It should be kept in mind, that the entire pineapple peeling, coring, slicing and trimming line is very old, dating back to the early sixtees. It was part of the Kia Orana Foods Corporation Ltd, when it was a pineapple cannery and was left for several years outside this plant, when the pineapple canning operation by the original New Zealand operator ceased.

B, 5 Raw Materials

a. Pineapple Procurement

The pineapple picking and deliveries are arranged by the Agricultural Officer and the Pineapple extension officer. The pineapples are grown in small fields or lots rarely exceeding one acre each. The cultural practices vary from excellent to poor. The

quality of the pineapples is very heterogenious. They are graded in the field for size, maturity and general quality. Only the larger size suitable for processing on the Ginaca with its 3 1/4" cutting head is brought to the plant.

The smaller sizes were intended for the alcohol factory on Mangaia, but it has not been working regularly this season. At the plant the pineapples are transferred from truck or tractor trailer to heavy duty plastic containers measuring 32" x 12" x 10" deep and weighed. The weights are registered by the lady taking care of the book keeping.

The plant pays 15 cent per kg pineapple. This pineapple season is abnormal in the sense, it started one month late in mid December rather than mid November and they are maturing very fast.

The plant is aiming at one half mature fruit for its sugar dipped dehydrated pineapple product. It is expected, that the total tonnage delivered to the plant this season will be very small namely about 300 tons

which is far short of the 2000 tons the original operator, Mr Grieco had planned for.

The plant capacity this season is thus grossly under utilized.

b. Utilities

b,1 Electricity

The Electric Power Supply (EPS) Department is responsible for supplying the electricity to the plant. There are two diesel powered electric generators at the plant. They are both only 2-3 years old. They have been delivered by Newage Stamford Co. Ltd. of Australia but the generators are manufactured in England and the diesel engines are of West German manufacture (Deutz). The Newage Stamford generators have the following specifications:

A.C. Generator, Type C 344 D, PF 0.8, Volts 380/440, KVA 125, AMPS 190/164, XX Citation Volts 35, HZ 50, Phase 3, RPM 1500.

One generator only supplies ample electricity for the factory. The other

generator serves at present as a reserve stand-by.

b.2 Water Supply

The plant receives its water supply from two sources, namely boreholes with diesel powered pumps and runn off water collected in the two 10,000 gallon cement water tanks in the back of the plant. The Public Works Department is responsible for the first source and the plant for the second. The plant has an ultra violet sterilizing unit with pressure pump to sterilize its own roof run off water.

The water supply situation is often very critical because of bore hole water pumps often break down. The plant can collect more roof water, since the front of the roof is not yet used for water collection. It would then have to build at least one additional tank.

The Public Works Department was supposed to procure two additional diesel powered water pumps for the bore holes, but they

have not arrived so far. At present it has two diesel powered water pumps of which usually only one functions and occasionally none. There are at present 5 bore holes, which appears able to provide a steady supply of water aside from extraordinary dry seasons. Each water bore hole pump can supply approximately 30 gallons of water per minute.

The precarious water supply situation did result in water shortage for the plant and it ran out of water on January 9, 1986, but the manager was able to provide sufficient water in tanks from the Public Works Department to keep the plant operating the following day.

<u>There is a need to review this water supply situation with the Public Works Department to make more adequate arrangements</u>.

b,3 <u>Fire Wood Supply</u>

The Mangaia Island Council is responsible for the supply of firewood to the plant to feed the wood burner.

They collect the firewood around the island. It is sawn into approximately 3 feet long logs, which often times are very heavy. The Waterwide wood burner will burn these large logs provided they are left for some time in the upper parts of the wood burning chamber, i.e. the chamber is filled up to the top so the wood gets a chance to dry before it reaches the actual burning zone at the lower part of the chamber.

The plant pays NZ$25 per ton firewood delivered at the plant.

C. Management and Labour

Following the signing over of the Mangaia Fruit Dehydration Plant to the Cook Islands Government July, 1985 it was combined with the likewise Government owned Kia Orana Foods Corporation Ltd, Rarotonga and under the direction of its executive Director, Michael E. Benns who was instrumental in the appraisal of the Mangaia Fruit Dehydration Plant at the time the former operator Mr Grieco indicated his desire to give up the venture. Mr Benns also played an important part in the decision to rehabilitate the plant to make it operative

for the 1985 86 summer crop of pineapples He has also served as the manager and past two years executive director of the Rarotonga Pineapple Canning Plant after the former New Zealand operators ceased to can pineapples and signed the plant over to the Cook Islands Government 5 years ago.

Mr Benns chose Steven Peyroux as Manager of the Mangaia Plant and the UN volunteer food technologist John Koruthu as part time food technologist to the Mangaia Plant.

Steven Peyroux has mainly experience in fruit juice production from oranges but also other fruit, working at the Kia Orana Foods Corporation Ltd in Rarotonga. He also has experience in the mechanical aspects of operating food machinery and is very adaptable to cope with new problems. He has, however, not had specific experience in processing pineapples into dehydrated pineapple and it would be beneficial for him to get some in plant training in a successful commercial pineapple processing plant.

Mr Michael Benns has been manager of the Cook Islands Liquor Supplies for approximately 16 years and has been involved in various other commercial ventures. He has lately been involved in the marketing of food products

and attended a Food Trade Fair in Los Angeles, California, USA December, 1985 and made contacts with importers of dried fruits in USA. He has also made such contacts in New Zealand.

A local woman is taking care of most of the bookkeeping in the office. She weighs in the pineapples and records the weight. She also helps on the processing line when she has time. There are five other female workers in the plant, all local.

There are six Mangaian male workers in the plant. Female as well as male workers did not have specific experience in working in a pineapple processing plant but are very cooperative and willing. They do need close supervision and it is essential to keep pointing out the dangerous nature of the machines and not least the HONIRON Ginaca and the slicing machine. Also the need of the greatest hygiene, since they are working with food products.

It appears, the management as well as the labour are gaining valuable experience during this the first actual season, the Mangaia Fruit Dehydration plant has worked. It is felt that this period is more of a plant break-in period and that the experience gained will pave the way for improved overall performance during the coming processing seasons.

It is hoped other products may be added to the production to assist in making the plant profitable and that the flexibility of the management and labour may make it possible to handle such additional types of products.

D. Operating Costs

In this operating cost analysis all capital inputs made by Grieco Foods (Cook islands Ltd) Mangaia Island plus the settlement cost with Grieco of NZ$20,000 plus the plant recommissioning cost of NZ$200,000 is considered written off by the Cook Islands Government, reasoning tnese were all grants. This includes additional miscellaneous costs estimated at NZ$50,000. An overview of the total capital inputs is given in Table

1. The decision to rehabilitate the plant is overwhelming to secure an outlet for pineapples grown in Mangaia. The following operating cost analysis does thus not include the normally very significant cost of depreciation of building and plant equipment. The plant also works on a very minimal working capital at the moment, which renders the operation difficult. Above does not exclude the need for additional capital inputs. The poor functioning of the entire pineapple peeling, coring, grading, trimming and slicing line dictates the stark need of rebuilding and/or replacing

this entire line. The waste of sound pineapple eradicator and other flesh plus juice indicates the need of a juice set-up possibly including a small plate sterilizer (can be operated with recirculating hot water from the hot water blancher and recirculated cold water).

There are also other immediate capital outlay needs for such as treating the cement floor in the processing room against the adverse influence of the acid pineapple juice plus resealing the entire plant tin roof, which is leaking badly.

Although the initial processing in the Mangaia Fruit Dehydration plant is only processing of pineapples it is still anticipated, that other fruits such as papaya may be processed to increase the total processing volume.

TABLE 1.

CAPITAL INPUTS MADE BY THE MANGAIA FRUIT DEHYDRATION PLANT DURING THE GRIECO FOODS (COOK ISLANDS) LIMITED PERIOD (UP TO JULY, 1985) AND UP TO RECOMMISSIONING, DECEMBER, 1985

		NZ$ 000's
A.	Grieco Foods (Cook Islands) Ltd period	
1.	Cook Islands Government (CIDB)	
	Processing Building	348
	Cool Room Insulations	12
	Water Purifier	15
	Extensions	29
	Reimbursement, Materials	13.4
	Electric Power Supply	141
	Water Supply & Access Roads	5
	Gas Supply	20
	Port Facility Upgrading	7.5
	Total Cook Island Government	590.9
2.	Grieco Foods (Cook islands) Ltd	
	Capital Equipment*	525
3.	Boral Australia Ltd	
	LPG Facility and Pipings	405
	Total Grieco Period	1,520,900
B.	Recommissioning Costs	
	Settlement Cost with Grieco Foods	20
	Waterwide Company	200
	Miscellaneous	50
	Recommissioning Costs	270
	Total	1,790,900

* This item, Grieco Foods (Cook Islands) Ltd is not itemized and no list of this capital equipment valuations have been located.

D.1 Raw Materials

Pineapples are produced by small scale growers and deliveries are arranged by the agricultural officer and pineapple extension officer. At present Kia Orana Foods Corporation Ltd offers NZ $ 0.15/kg.

D.2 Estimated Costs for Utilities

Estimation of the cost for utilities is partly based on information given by the Grieco Foods (Cook Islands) Ltd and for wood consumption by the Waterwide Development Corporation, New Zealand.

TABLE 2

Estimated Costs for Raw Materials and Other Supplies

Sugar, 25 tons @ NZ$1000	25,000
Pineapples, 600 tons each NZ$150	90,000
Cartons with Plastic Pouches, 4000 @ NZ$ 0.40	16,000
Bisulfite 100 kg @ NZ$100	100
Sorbate 20 kg @ NZ$40	800
TOTAL	131,900

TABLE 3

Wood for wood burner, 100 tons each NZ$25	2,500
Electricity and water for 12c days @ 150	18,000
TOTAL	20,500

TABLE 4

Estimated Labour Management Cost

10 Workers 120 Days/1 shift	
10 x 120 x 8 x NZ$ 1.50	14,400
2 Workers 26c Days, 1 shift	
2 x 260 x 8 x NZ$1.50	6,240
1 Plant Manager	10,400
TOTAL	31,040

D.3 Estimated Labour and Management Costs

These are shown in Table 4.

D.4 Estimated Property and Inventory Insurance Costs

These are shown in Table 5.

D.5 Summary of Estimated Annual Operating and Administration Costs

These are shown in detail in Table 7.

D.6 Estimated Sales Revenue

Originally Grieco Foods (Cook Islands) Ltd estimated that the ratio finished dehydrated pineapple to raw product as 1:10. The initial plant test run gave this as 1:20, but the processing and particularly the peeling, coring and slicing operations initially gave a great deal of trouble. This has improved somewhat, but an actual figure will not be available until after the end of the pineapple season because of the extended sugar solution and drying operations.

Table 8 shows actual yields of canned pineapple flesh and juice in two southern African countries. One was a modern, large scale plant and the other a small scale primitive plant. It is expected the Mangaia plant operation will improve and efficiency increase with the recommended

improvement and that the ratio finished to raw product will improve to approximately 1:15. This ratio is used in calculating the estimated pineapple sales revenue shown in Table 6 and juice from waste is estimated as 15% of gross weight.

D,7 Estimated Working Capital Requirements

These are shown in Table 8.

TABLE 5

Estimated Property and Inventory Insurance Costs

Property Values		1000's
Equipment		1,000,000
Buildings		350,000
Inventory		
Wood, 10% of annual		250
Packing Materials, 50% of Annual		8,000
Finished Product, 50% of Annual		135,000
TOTAL		1,493,250
Insurance = 0.125%	NZ$	18,666

TABLE 6

Estimated Pineapple Product Sales Revenue

Dehydrated Pineapple 40,000 kg @ NZ$4.00 at plant =	160,000
Pineapple Juice 90,000 litres @ NZ$0.80 at plant =	72,000
TOTAL SALES REVENUE	232,000

TABLE 7

Summary of Estimated Annual Operating and Administration Costs

	000's
Raw Materials	31,900
Utilities	
Wood	2,500
Electricity and Water	18,000
Labour : Management	31,040
Maintenance of Equipment, 4%	
TOTAL	183,440

TABLE 8

Estimated Working Capital Requirements

	'000's
Payroll (10% of annual cost)	3.1
Raw Materials (50% of annual cost)	219.0
Finished Stock (50% of annual Sales)	116.0
Utilities (50% of annual cost)	10.3
Accounts receivable (25% of annual sales)	58.0
TOTAL	253.400

TABLE 9

Actual pineapple recovery rates during the 1981.82 season at a large scale modern commercial plant:

			Small Primitive Plant	
	kg	%	kg	%
Tonnes used	339,580		679,817	
Flesh recovered and canned	71,489	21.1	35,907	5.3
Juice " " "	43,317	12.8	21,894	3.2
Juice from eradicator				
Rejects+tops+bottoms for syrup in cans	20,250	5.9	Nil	Nil
Total	135,056	39.8-	57.741	8.5
Waste Truck weight	156,980	46.2	349,272	51.4
Waste Screening	2,440	0.7	Nil	Nil
Totals	159,420	46.9	349,272	59.9
Grand Total	294,420	86.7	407.013	59.9
Unaccounted	45,104	13.3	272,804	40.1

The "unaccounted" amount comprising 13.3% is presumed drippings, evaporations and general spillings.

The 1981/82 season figures for the small scale cannery have been inserted. They are for 18 days of processing. it is obvious the recovery rates are very low, namely a total recovery of 8.5% versus the 39.8% for the modern large scale commercial plant during the same season.

It should, however, be pointed out, that the large modern canning company operates modern plantation and outgrower production of pineapples while the small plant obtains its pineapples from very small growers. The pineapples are, however, graded in A and B sizes at the 8 pickup market places. It seems hard to account for the enormous difference in recovered flesh except by poor processing methods at the small cannery, which points out the need for rehabilitating the plant.

E Marketing

The marketing of the sugared, dehydrated pineapple product or other products the plant may manufacture, is of the greatest importance and needs to be investigated as soon as possible and as thoroughly as possible. The executive dirctor Michael E. Benns has made some enquiries, among others in New Zealand and USA. New Zealand CIF prices per kg in June-July/85 varied between NZ$3.60 and 5.55. The New Zealand market is, however, rather small namely about 60 tons/anno for the sweetened dried pineapple product. Michael E. Benns also attended the November/85 Los Angeles Food Trade Fair and made contact with some US importers and/or processors of dried pineapple products. The sweetened dehydrated pineapple products are among others used in the cereal industry to mix into fruity cereals as small vacuum dried pieces to bring about a fruity flavour to the product. The potentially interested parties did quote some prices, and asked to have samples of the Mangaia product forwarded for evaluation. They are at present procuring the product from Taiwan. Ria Orana Foods Corporation Ltd has already obtained samples of the sweetened dehydrated pineapple product from Taiwan.

There is a need to make an in-depth investigation of the World Market for the dehydrated sweetened and

unsweetened pineapple products. There are numerable sources for this. UNCTAD/GATT (The International Trade Center in Geneva, Switzerland) collects such information and the expert has sent a telex to them to inquire about their information but received no answer.

The European Economic Community (EEC) in Brussels, Belgium collects detailed statistics on EEC imports of such products and UK Chamber of Commerce collects the same but for UK only. Although freight is rather high to Europe, the EEC market should not be entirely prejudiced.

Although Japan is closer to Taiwan, the Japanese market should not be neglected, since it is a very big market for tropical and subtropical fruit products.

The US market has been interested in health foods among which certain low calorie dried fruit products have been popular. The sweetened dehydrated pineapple products have not been popular among this type of foods but a certain dehydrated pineapple product with a chocolate-like low calorie coating has had consumer acceptance according to some super market purchasing agents interviewed by the expert. There is a need to follow this up and obtain more detailed information about this product and any other products in the low calorie category showing consumer acceptance.

Australia does process considerable amounts of pineapple but whether they also produce dehydrated pineapple products is not known by the expert. This information is, however, probably available in Australian Government Statistics and their Chamber of Commerce.

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