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ESTABLISHMENT OF A FOOD-PROCESSING PLANT AT JAMPRO

DP/JAM/88/009

JAMAICA

Technical report: Techno-economic study on processing and marketing of tropical fruit juice concentrate and fruit purees in Jamaica*

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

Based on the work of Mr. Christer Cronberg,
Agro-industrial development adviser

Backstopping officer: B. Calat,
Agro-based Industries Branch

United Nations Industrial Development Organization
Vienna

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* This document has not been edited.

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TABLE OF CONTENTS

X. International market for tropical purees:

COMMENTS OF THE PROJECT BACKSTOPPING OFFICER

Jamaica is one of the biggest tropical fruit producing countries in the Caribbean region. The serious problem which Jamaica and many other developing countries are facing is how to export the excess production of the valuable tropical fruits. There are several possibilities to export fruits at much cheaper prices, comprehensive experience is available on how to export fresh fruits, value-added products, i.e. processed fruit products like confiture, puree, juice, etc., which have a big export potential.

It was Mr. Cronberg's task to prepare a techno-economic study on processing and marketing of tropical fruit juice concentrate and fruit purees in Jamaica. In his report different alternative processing methods are examined, evaluated and suggestions and recommendations for export have been made. The report comprises valuable information on the international market for tropical fruits as well as on various processing technologies like e.g. aseptic packaging. Mr. Cronberg's report contains very useful techno-economic information on the whole national fruit industry, from the farming side, production yield, acreage, varieties of tropical fruits to the processing industry and marketing. His report can be considered as a valuable tool and source of information for JAMPRO and the national fruit industry for the development of an appropriate fruit processing value-added industry, and with a view to the establishment of linkages among fruit growers, processors and distributors and to the creation of the appropriate mechanisms for access to the international market.

I INTRODUCTION

1.1 Jamaica, with its tropical climate, has an increasing production of citrus and other tropical fruits, such as mango, papaya, guava and pineapple. Further expansion of the production and processing both for export and domestic use of a number of selected fruits could be a good potential to diversify and expand the export from Jamaica.

1.2 Jampro, Jamaica's export development agency, has decided to investigate the viability to establish a processing plant for tropical fruits. The project will be carried out by the private sector, and a few selected companies have taken active part in the preparation of the feasibility study.

1.3 The preparation of the feasibility study has been made possible under a technical assistance programme financed by United Nations Industrial Development Organization (UNIDO).

1.4 The investigation and preparation of the study has been carried out in two separate phases:

(i) market investigation in Europe/USA

(ii) investigations and surveys in Jamaica, as well as discussions with sponsors, government and financial authorities.

1.5 Exchange rate used: US$ 1.0 = J$ 8.00

1.6 The investigation and preparation of the report has been made by:

Christer Cronberg, Sweden
Address, see annex.

II. SUMMARY

2.1 The viability of the establishments of a medium sited fruit puree processing plant has been evaluated.

2.2 The project, based on the exports of 2000 tons banana puree, 600 tons of mango puree and 400 tons of papaya puree is viable, based on conservative price estimates with regard to the expected market prices.

2.3 The market for the projected sales volumes at the calculated prices would be further evaluated with the assistance of Pittrex Handels geschell schaft in Hamburg, Germany, a possible share holder.

2.4 The two main sponsors would be

The Jamaica Banana Producers Association Ltd.

The United Estates Ltd.

In addition it is expected that

Inter america Investment Corporation, and Pittrex Handels geschell schaft would be minority share holders

2.5 Total investment would be about US$ 2.3 million. At full development the project could generate about US$ 1.0 million net earnings in foreign exchange per year.

III BACKGROUND

3.1 Jamaica has an excellent climate and microclimates for the growing of a number of tropical fruits. However, commercial production of tropical fruits are mainly limited to citrus (orange and grapefruits), mango, papaya and ackee. Most of the fruits are produced by small scale farmers, mainly geared for the fresh fruit market.

3.2 A large part of the fruits are purchased by so called "higglers" which are acting as middlemen/women between the producers and the urban buyers. The higgler system works in different levels.

The higgler system provides the urban market with agricultural commodities including fruits.

3.3 The export of tropical fruits including bananas has varied considerably during the last number of years. Jamaica export mainly bananas to England, and The Jamaica Banana Producers Association has developed both the shipping as well as the distribution of bananas to UK in an efficient way. Normally one ship leaves Jamaica to UK/Europe each week. Several times these reefers have spare capacity and can bring additional products, such as aseptically packed fruit purees in steel drums.

3.4 Jamaica with its surplus of bananas, own transport fleet to Europe, and good climate for expansion of the production of tropical fruits, has a good potential to diversify its market into export of aseptically packed tropical fruit purees

IV PRODUCTION OF FRUITS

4.1 The production of different types of fruits are scattered all over the island. The production are mainly by small holders and only sugarcane, coconuts and bananas are produced by larger units.

4.2 Jamaica is a hilly island and it is mainly in the valleys where small plantations of fruits are developed. The production of fruits is dispersed over large areas and by small producers. The small farmers do not focus in obtaining maximum yields from his fruit trees, but more on a subsistence level of combined production from his different types of activities, involving livestock, some farming and fruit trees.

4.3 The island has relatively poor infrastructure which makes the collection of fruits difficult and expensive. Small traders, middlemen/women (called higglers) are buying the fruits and other agricultural products from the producers and resell the products in the main cities of Kingston, Montego Bay and to places like major hotels and restaurants.

4.4 Processing plants, using fruits and vegetables as raw material can be divided into three categories:

(i) Companies which use their own land for their main production and which are buying additional products from small producers. Such companies are : Southern Food Processors.

(ii) Companies which are processing the production from their associates like Jamaica Citrus Growers Ltd. processing citrus fruits mainly into concentrate(orange juice and grapefruit juice) and some canned products.

(iii) Companies which buys their raw material through arrangement with farmers and the open market.

4.9 Detailed production costs for banana, mango, papaya and guava is attached in Annex 2. The yield per acre at full production is calculated to be as follows:

Banana	:	16,000 lbs/acre
Mango	:	23,000 lbs/acre
Papaya	:	20,000 lbs/acre (average over 3 years)
Guava	:	25,000 lbs/acre

These yields are based on the assumption that the orchards are well maintained, weed control is applied and fertilizers are used.

4.10 Average yields of the fruit trees in Jamaica is lower. The Ministry of Agriculture estimates the yields as follows:

Banana	:	16000 lbs/acre
Mango	:	2400 lbs/acre
Papaya	:	1200 lbs/acre
Guava	:	2000 lbs/acre

4.11 Due to the average low yields of the orchards or plantations now in production in Jamaica, production costs are higher than if the production would have been done under more technical and advanced systems.

4.12 The farm gate prices for fruits sold are linked to the fresh fruit sold as such to the consumer or high quality fruits sold for export. Prevailing prices are as follows (1989):

Banana	:	J$ 0.6 - 0.8/pound (non-exportable bananas)
Mango	:	J$ 1.20/pound
Papaya	:	J$ 1.35/pound
Guava	:	J$ 1.50/pound

4.5 Average production of the main fruits are, according to the statistics from the Ministry of Agriculture, as follows:

Banana	120,000 tons (export 50-60,000 tons)
Pineapple	10,000 tons
Papaya	3,000 tons (export 420 tons)
Mango estimated production	3,000 tons (export 570 tons)
Sweet orange	21,000 tons
Grapefruits	14,000 tons
Ortanique	3,000 tons

More detailed production figures are given in the annex.

4.6 Commercial production of mango and papaya, will increase by establishment of new orchards, through targeted financing. Expected production in 1994 will be as follows:

Mango (1500 acres)	8800 tons
Papaya (500 acres)	6800 tons

It could be that the development will slow down somewhat due to the present high interest rates (28.30 % p.a.).

4.7 Calculated production cost, at full yield, of the following fruits are as follows (for export) :

Banana	J$ 1437/ton	or	US$ 180/ton
Mango	J$ 3550/ton	or	US$ 444/ton
Papaya	J$ 788/ton	or	US$ 98/ton
Guava	J$ 3043/ton	or	US$ 380/ton

A fairly part of the production cost is the cost of the boxes for export.

4.8 Production cost for processing can be calculated to be lower, due to the use of simple returnable boxes, for the transport of the fruits to the processing plant:

Banana	J$ 791/ton	or	US$ 99/ton
Mango	J$ 2631/ton	or	US$ 329/ton
Papaya	J$ 788/ton	or	US$ 98/ton
Guava	J$ 2162/ton	or	US$ 270/ton

V PRESENT PROCESSING SECTOR FOR FRUITS

5.1 The main fruit processors in Jamaica are:

Musson Food Processors
Grace Canning
Scott's Manufacturing
Southern Fruits and Food Processors
Jamaica Citrus Growers Ltd.
United Estates Ltd.
Fruits of Jamaica Company.

5.2 All the processors are small to medium sized, working with relatively simple processing equipment. Jamaica Citrus Growers Ltd are exporting citrus juice concentrate and is the largest exporter of processed fruits. The company will make further expansions in its evaporation plant.

5.3 Except Southern Fruits and Food Processors, United Estates Ltd and Citrus Growers all other Jamaican fruit processors are buying their raw material from higglers and from farmers themselves. Southern Fruits and Food Processors is at present relatively its plant and is not ready for further expansions, Citrus Growers will expand its evaporation plant and would wait for further evaporation project is done.

5.4 United Estates Ltd. has a small efficient plant processing orange into a high quality orange juice distributed on the domestic market.

United Estated Ltd. would be suitable for further expansion, and the company works closely with Jamaica Banana Producers Association Ltd.

VI. PROJECT

6.1 The Project would include the establishment of a processing plant which would be able to process a number of fruits into fruit puree. Sterilize the puree and aseptically pack the puree into sterile containers. The volume of the containers would be 200 litres to fit into 200 litre steel drums. Most of the puree will be exported to the U.S.A. and Europe.

Brief Technical Description

6.2 It is expected that the processing plant can be built into an existing building. The building has to undergo a profound renovation to get up the hygenic standard needed for an export-oriented operation. The water installation and electricity would be available while a new boiler would need to be installed. The processing plant would consist of the following main units:

- reception and inspection of fruits
- hand peeling of certain fruits
- crushing and vacuum treatment
- heat treatment and cooling
- aseptic filling

The drums will be stored in chilled store before exported through Kingston Port. Detailed technical description is given in Annex of the key components.

Estimated Investment Cost

6.3 The summarized estimated investment cost is as follows:

	(J$'000)	US$ Equivalent
Rehabilitation of existing building	2040	255,000
Utilities	920	115,000
Chilled Storage	1016	127,000
Equipment	7472	934,000
Freight, Training and Installation	1888	236,000
Vehicles	552	69,000
Office Equipment	112	14,000
Interest During Construction	904	113,000
Initial Working Capital	1672	209,000
Physical Contingencies	1656	207,000
Price Contingencies	832	104,000
	19064	2,383,000

Investors

6.4 A new company will be formed to establish the project. The proposed investors would be the following four companies and corporations:

(i) Jamaica Banana Producers Limited

(ii) United Estates Limited

(iii) Inter American Investment Corporation

(iv) Pittree Handels gesell shaft, Germany.

6.5 Jamaica Banana Producers Limited is the largest banana producers in Jamaica. The company has their own refrigerated ships transporting bananas to the United Kingdom and Europe. Normally, one ship leaves from Jamaica to Europe each week, making it possible to transport fruit puree to Europe at a lower freight rate and frequently Jamaica Banana Producers Limited also have a well established distribution network in the U.K. and a new distribution chain is being built up on the European Continent.

Further information about Jamaica Banana Producers Limited is given in Annex (Annual report 1989)

6.6 United Estates Limited is a family owned company operating 5,400 acres, producing mainly citrus and sugarcane. The citrus (orange) is exported fresh in boxes as well as in bulk. The oranges exported in bulk are pressed in the U.K. and sold non-pasteurized as a high quality drink. United Estates uses space reefer space on Jamaica Banana Producers' ships to get their oranges to the U.K. The company also operates in addition to their citrus packing line, a new processing unit for pasteurized high quality orange juice sold in Jamaica.

Total sales in 1990 was J$48 million with a profit of J$4.5 million. Expected sales in 1991 is calculated to be about J$80 million. The increase comes from the citrus juice plant operating at full capacity in 1991. About 60% of sales in 1990 was export.

United Estates Limited employs about 2,000 persons. The company buys fruits also from a large number of small producers surrounding the fruit packing and processing plant.

6.7 Interamerican Investment Corporation (IIC) was established in 1988 under Interamerican Development Bank. The objective of the Corporation is to promote the establishment of small and medium sized export oriented companies, to promote employment and transfer of technology. IIC can participate in equity as well as in financing of a project.

6.8 Pittree Handels geschell shaft is a trading company located in Hamburg, Germany, specializing in the sales of tropical fruit juice concentrates and fruit purees. Pittree trades about 35,000 tons annually of which one third comes from Argentina. The breakdown of the last years' sales have been as follows:

Orange juice concentrate	-	20,000 tons from Brazil
	-	2,500 tons from Argentina
Pineapple juice concentrate	-	6,000 tons
Grapefruit juice concentrate	-	3,000 tons from Argentina
	-	3,000 tons from Others
Lemon juice concentrate	-	6,000 tons from Argentina
Other fruit juices/purees	-	5,000 tons

Financing

6.9 The proposed financing would be as follows:

Equity: US$1,000,000 equivalent

Jamaica Banana Producers:	Equiv.	US$500,000
United Estates:	Equiv.	US$200,000
Interamerican Investment Corp:	Equiv.	US$200,000
Pittree:	Equiv.	US$100,000
TOTAL	Equiv.	US$1,000,000

Financing: US$1,383,000

Interamerican Investment Corp:	US$550,000
National Development Bank:	US$624,000
Commercial Bank (working capital):	US$209,000
TOTAL	US$1,383,000

Location

6.10 The new plant is proposed to be located at Bog Walk. The city is in the centre of the Eastern part of the country. Bog Walk is situated rather close to several of the large new citrus plantations.

6.11 The plant will be built next to the present packaging and processing plant of United Estates, and some facilities would be leased from the United Estates plant, such as offices, facilities for the personnel as well as water and electricity. By this arrangement, the investment can be reduced and the management structure of the well operated United Estates plant can be extended into the new company.

Organization

6.12 The new company to be created will have a relatively small small organization and buy administrative and personnel service from United Estates.

The proposed organization would be as follows:

Board of Directors

Banana Growers:	3 persons
United Estates:	1 person
IIC:	1 person
Pittree:	1 person

Management of the Company

Management:	Managing Director
Organization of raw material:	2 persons
Factory management:	2 persons
Sales of finished products:	3 persons
Processing plant:	8 Supervisors 32 workers

VII SUPPLY OF RAW MATERIAL

7.1 The capacity of the processing plant is closely linked to the aseptic packaging unit. It is prepared to install one Star-Asept, aseptic bulk filling machine, which can handle up to about 2000 litres of product per hour, if large 500 - 1000 litre containers are used. For export purpose the fruit price will be filled into 200 litre container (220 kg) and the capacity of the filling unit would be around 1000 - 1200 kg per hour.

7.2 The proposed plant would be able to produce up to 6000 tons of puree per year, operating three shifts. For the purpose of the feasibility calculation, it is assured that:

Days of operation per year	200
Hours of operation per day	10
Out put per year	3000 tons

7.3 Jamaica has the potential to produce a large number of tropical fruits. For the purpose of the feasibility calculation it is assured that the following main products would be sold:

Banana puree	2000	tons/year
Mango puree	600	tons/year
Papaya puree	400	tons/year

7.4 Yields from raw material to fruit product is estimated as follows:

Banana	:	70%
Mango	:	50%
Papaya	:	45%

7.5 The need for raw material would be:

Bananas	:	2857 tons
Mango	:	1200 tons
Papaya	:	890 tons

7.6 Banana

Jamaica has a large production of bananas (export in 1989 was 42,607 tons), which relates to a production in the range of 100 - 150,000 tons in the Country. In the export packing houses relatively large amounts of second quality bananas are sorted away, because it cannot be exported. This second quality bananas (with skin blemishes, but still good quality inside) would be very suitable for processing into pulp. It is estimated that at least 20 percent of the bananas going to the packing houses are sorted away. The packing houses surrounding the Bog Walk city can provide 3000 tons of bananas.

Price to be paid, to cover transport and handling cost and a J$ 0.10 margin per pound, would at present be J$ 0.75/pound, equivalent to J$ 1652 per metric ton.

Mango

7.7 Jamaica grows many types of mango. The last years expansion programme, up to 1500 acres planted with mango, involves mainly the variety "Tommy Atchins", a large fruit with a small stone, suitable as a table fruit. Unfortunately, the fruit lacks a good flavour, and is not alone very suitable for processing. The "Tommy Atchins" variety could however be used to a certain extent with other better flavoured mangoes, like "Common Mango Number 11" and the variety "Bombay".

7.8 The estimated amount of mango grown in Jamaica is about 3000 tons, with a growing amount coming into production within the next few years.

7.9 The planted 1500 acres of mango could yield up to 10,000 tons at full development.

Relatively, the total output would probably be lower. Output in 1994 is estimated to 8800 short tons.

7.10 It is estimated that about 1200 tons of mango (both the variety of Tommy Atchins and common mango would be available for processing within the next 3 - 5 years.

7.11 Price panel for mango for processing would be in the range of J$ 0.70 per pound.

Papaya

7.12 Papaya is grown widely in Jamaica. Annual registrated output is about 10,000 tons per year. New plantation will expand the production. Most of the papaya goes to the fresh fruit market.

It would be possible to obtain about 900 tons in another 2 - 3 years time, assuring that the plantation of papaya would develop as planned.

7.13 Prices paid for papaya for processing would be in the range of J$ 0.75 per pound.

VIII MARKET

8.1 The market for banana puree has been expanding during the last few years, packed both in aseptic packages and frozen. Some banana products are also sold at 40°Brix concentrate. The end - users are the dairy industry, the beverage industry and the baby food industry.

8.2 The initial study of the market prospects for tropical fruit purees did not focus on banana puree, but on many other more exotic products. Several traders expressed interest in banana puree, but no volumes were mentioned. Price for seedless banana puree is about US$ 800 per ton CIF Europe.

8.3 Further investigations of the volumes traded in banana purees will be investigated as well as price fluctuations during the last few years.

8.4 The market for mango puree, mainly single strength is expanding. Prices varies, however, very much pending on the quality of the puree. A good quality puree can catch up to US$ 1600 per ton. Due to increased domestic demand in India, export from this main supplier has dropped. Further information is given in the Annex.

8.5 Papaya puree has a relatively limited demand in Europe due to rather low flavour of the puree. Papaya puree is often used as a "filler" in different tropical fruit juices due to its relatively low price. Further information is given in the Annex. Possible volumes to be sold, both in USA and Europe would be about 400 tons.

IX FINANCIAL EVALUATION

9.1 Estimated operating cost are calculated in the attached annex. The calculation is based on prevailing prices.

9.2 The operating costs can be summarized as follows:

	J$ 000
raw material	8040
packing material	3200
energy	169
personnel/management	720
administration	300
maintenance	480
transport to Europe	2100
commission to trading houses	1024
cost of working capital	100
TOTAL	16,133

9.3 The expected revenue would be:

	J$ 000
2000 tons banana puree	12800
600 tons mango puree	5760
400 tons papaya puree	1920
TOTAL	20,480

9.4 It can be observed that the papaya puree would actually be operating at a loss. However, the product is included in the calculation because prices could be expected to be higher than US$ 600 per ton within the near future.

9.5 Following conditions for the loans (US$ 1,383,000 equivalent) from Inter American Investment Corporation and National Development Bank have been assumed:

Repayment period	10 years
Grace period for repayment of principal:	3 years
Interest rate (based on US dollar)	13 %

Debt service would be as follows:

	Interest	Principal	Total	J$ 000
Year 1	179,790	-	179,790	1438
Year 2	179,790	-	179,790	1438
Year 3	179,790	-	179,790	1438
Year 4	179,790	197,572	377,362	3019
Year 5	154,106	197,572	351,678	2813
Year 6	128,421	197,572	325,993	2608
Year 7	102,736	197,572	300,308	2402
Year 8	77,053	197,572	274,625	2197
Year 9	51,368	197,572	248,940	1992
Year 10	25,683	197,572	223,255	1786

9.6 The project will take one year to implement, and it is assured that the capacity increase would be as follows:

Year 1	implementation
Year 2	50% capacity
Year 3	80% capacity
Year 4 - 15	100% capacity

9.7 Cash flow for Internal Rate of Return calculation would be as follows (in J dollars ooo)

Year 0	- 16,560
Year 1	+ 2,173
Year 2	+ 3,477
Year 3 - 15	+ 4347

1 RR: 21%

If profit drops 5%, 1 RR would be 15%

If operating cash increase 5%, 1 RR would be 16%.

9.8 The cash flow including debt. Service would be as follows (the project calculation is based on 100 percent export, and consequently the Company would not pay any tax) :

	Investment	Net income	Debt service	Total
Year 0	-16 560	-	-	16560
Year 1	-	2173	1438	735
Year 2	-	3477	1438	2039
Year 3	-	4347	1438	2909
Year 4	-	4347	3019	1328
Year 5 (replacement	1656	4347	2813	122
Year 6		4347	2608	1739
Year 7		4347	2402	1945
Year 8		4347	2197	2150
Year 9		4347	1992	2355
Year 10-15		4345	1786	2559

ANNEX I

JAMAICA

PROCESSING AND MARKETING OF TROPICAL

FRUIT PUREES

The investigation and report has been made during a six weeks' assignment by:

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ANNEX II

JAMAICA

PROCESSING AND MARKETING OF TROPICAL FRUIT PUREES

AVERAGE YIELDS OF SOME SELECTED FRUITS

YIELDS

Bananas	:	8 short tons per acre
Guavas	:	2000 lbs. per acre
Large tree mango:		250 dozen per acre
Small tree mango:		200 dozen per acre
Papaya		1200 lbs/year/acre

ANNEX III

JAMAICA

PROCESSING AND MARKETING OF TROPICAL

FRUIT PUREES

HARVEST SEASONS

Mango	:	start May good June - July finished August
Pineapple	:	start June good July finished August
Bananas	:	all through the year
Papaya	:	all year

ANNEX IV

JAMAICA

PROCESSING AND MARKETING OF TROPICAL

FRUIT PUREES

PRODUCTION OF PAPAYA, PINEAPPLE AND BANANAS

Production in :Short Tons (2000 pounds)

	Papaya	Pineapple	Bananas (export)
1979	1631	2670	68,834
1980	1376	4296	33,107
1981	2126	5368	18,774
1982	1832	9031	21,878
1983	1821	6973	23,539
1984	2345	8823	11,058
1985	2293	8170	12,742
1986	2427	7789	20,000
1987	3180	8150	32,000
1988	3199	10,345	28,058
1989	3500	10,704	

ANNEX V

JAMAICA

PROCESSING AND MARKETING OF TROPICAL FRUIT PUREES

PRICES (FARM GATE AND MARKET) FOR PAPAYA, PINEAPPLE AND SORREL

Price in: J cent per pound

	Papaya		Pineapple		Sorrel
		Market Price		Market Price	
1979	17	27	31	42	56
1980	25	58	45	58	63
1981	23	49	47	86	69
1982	27	49	45	92	103
1983	29	63	53	95	112
1984	30	65	60	106	146
1985	38	91	73	144	179
1986	50	118	88	181	224
1987	91	157	108	204	262
1988	103	186	96	247	213
1989	135	258	135	308	313

ANNEX VI

JAMAICA

PROCESSING AND MARKETING OF TROPICAL

FRUIT PUREES

PRODUCTION 1990 OF SOME FRUITS

	Quarter	Area	Production	Farm Gate Price
		Acre	S - ton	Cents/lb
Papaya	I	254	1673	148
Pineapple	I	283	2230	156
Sorrel	I	451	225	315
Papaya	II	125	787	136
Pineapple	II	534	4065	134
Sorrel	II	-	-	-
Papaya	III	159	981	163
Pineapple	III	500	3676	172
Sorrel	III	-	-	-

S ton = 2000 pounds

ANNEX VII

JAMAICA

PROCESSING AND MARKETING OF TROPICAL

FRUIT PUREES

FARM GATE PRICES

Prices:	cents/lb	1989		Quarters	1	2	3	4
av.	135		papaya		135	113	141	149
av.	135		pineapple		165	118	159	181

ANNEX VIII

JAMAICA

PROCESSING AND MARKETING OF TROPICAL

FRUIT PUREES

PRODUCTION AND FARM GATE PRICES OF CITRUS

PRODUCTION IN : 1000 boxes
PRICES IN : J$ per box

	Sweet Orange		Grapefruit		Ortanique	
		Price		Price		Price
1978	408	1.05	370	0.70	82	1.31
1979	309	4.00	388	2.20	29	4.00
1980	506	4.25	451	2.55	137	4.25
1981	329	4.40	487	2.00	52	4.40
1982	384	5.00	468	2.10	48	5.00
1983	319	5.00	301	2.10	55	5.00
1984	281	8.50	230	2.50	56	8.50
1985	429	15.50	230	8.00	54	15.50
1986	471	17.50	371	8.50	87	17.50
1987	308	N/A	230	N/A	23	N/A
1988	528	N/A	348	N/A	78	N/A

Grapefruit : 1 box = 80 - 120 fruits

Orange : 1 box = 175 - 200 fruits (90 pounds)

ANNEX IX

JAMAICA

PROCESSING AND MARKETING OF TROPICAL

FRUIT PUREES

EXPORT OF FRUITS
(POUNDS)

	1983	1984	1985	1986	1987	1988
Avocado	143,997	138,989	187,786	221,534	231,155	58,947
Guava	-		-	-	-	-
Lychee	-	-	-	650	-	-
Mango	717,333	678,311	1,180,987	715,203	1,093,046	1,256,016
Passion Fruit	30	-	-	-	-	-
Papaya	11,634	78,887	119,160	108,285	440,268	928,861
Star Apple	5,451	4,668	6,266	9,096	3,037	2,940
Sorrel	31,840	47,215	72,089	26,420	34,246	5,896
Banana	47,078,000	21,116,000	25,484,000	40,000,000	64,000,000	56,116,000

INTERNATIONAL MARKET FOR TROPICAL PUREES:

I. INTRODUCTION

1.1 JAMPRO has requested UNIDO to finance the preparation of a feasibility study for a proposed project to process different types of sub-tropical and tropical fruits into fruit juice concentrate and purees.

1.2 The study will evaluate the possible market for different types of concentrate and purees in Europe and USA, and access the production potential of different types of fresh fruits. Based on the market and the supply of raw material, a technical proposal will be made, in order to calculate the possible investment costs.

1.3 Taken into account the cost of raw material, the processing and packaging costs, the calculated investment and the possible sales price of the finished products, feasibility calculations will be carried out for different possible alternatives.

1.4 UNIDO has contracted the preparation of the first phase of the feasibility study which includes:

- discussions with selected traders in tropical fruit juice concentrate and purees in Europe;
- assessment of the overall trends of consumption and trade of the commodities.

1.5 The following fruit juice concentrates and purees have been analysed:

- orange
- grape-fruit
- lemon
- pineapple
- passion fruit
- mango
- papaya
- guava

1.6 The final preparation of the complete feasibility report will be done after the first phase has been evaluated. In addition UNIDO has to agree to continue to finance the second phase

1.7 The field work was carried out during September 11 up to October 6, 1978. The report was written during non-travelling days.

1.8 It should be noted that Jamaica has a trade benefit in Europe over the main Brazilian suppliers, since Jamaica is within the Lomé-convention.

Brazil imports to European Economic Community (EEC) have the following duties (which Jamaican imports would not have):

Orange juice concentrate	19 percent
Grape-fruit concentrate	7 percent
Mango fruit juice pulp	8 percent

II. BACKGROUND AND GENERAL TRENDS

2.1 The consumption of fruit juices and nectars has steadily increased during the last 35 years in the total world. The main markets which have shown the highest increases in per capita consumption are Europe and USA, both markets which have to import the main parts of their fruit juice raw material, with the exception of apple juice.

2.2 The world production of fruits has grown with an average of 2-3 percent per year, and at present an estimated 320 million tons of different types of fruits are produced.

Out of the total production, an estimated 180 million tons are produced in the sub-tropical and tropical zones and 140 million tons in the climatic zones. Out of the 180 million tons produced in the sub-tropical and tropical zones about 120 million tons are consumed directly as fresh fruits, and the balance, 60 million tons, is exported either fresh or processed.

2.3 World production of the most important fruits in 1972, 1980 and 1988.

Year	1972	1980	1988
Fruits	----- million tons -----		
Grape	52	65	60
Citrus	42	55	66
Bananas	34	37	42
Apple	20	35	41
Water melons	17	25	29
Mango	12	13	15
Plums	7	9	10
Pineapple	5	9	11
Peaches	6	7	8
Melons	4	7	9
Other types	n.a.	n.a.	___
			320

2.4 The per capita consumption of fruits, either fresh or processed, calculated as kilo fresh fruit equivalent is substantially higher in the rich developed world compared to the developing countries. An estimated 140 kilo fruits per capita is consumed in the developed countries, compared to only 30 kilos per capita in the developing countries.

2.5 The per capita consumption of tropical and sub-tropical fruits increases year by year in the developed countries. The main market segments are in orange and apple juice, but more "exotic" fruit juices are increasing their market share like:

* grape-fruit
* pineapple
* mango
* and tropical mixes.

2.6 The market is also getting more and more quality conscious, and the demand on high quality products, with good colour, aroma and a balanced acid / sugar content is increasing.

2.7 During the field work in detail personal discussions were held with eight large importers and buyers of fruit juice concentrate and purees. In total these eight traders handle about 200,000 tons of fruit juice concentrate and pulps.

2.8 All the buyers expressed their confidence on expanded market for sub-tropical and tropical fruit juices in addition to the main consumption of orange and apple juices.

2.9 The consumption of exotic fruit juices goes into:

- carbonated soft drinks;
- baby food;
- yoghurts;
- ice-cream;
- other food items.

III. MAIN MARKET ASPECTS OF A NUMBER OF SELECTED PRODUCTS

Orange Juice

3.1 The main supplier is Brazil, which at present completely dominates the market. The recent two frosts affecting the Florida producers of oranges are making the main buyers to relay more on the Brazilian production.

3.2 The Brazilian producers are making an excellent concentrate, and the main terminals in Europe, Rotterdam and Antwerp, have good mixing possibilities, to ensure the buyer a steady and high quality of the concentrate.

3.3 Nearly all Brazilian orange concentrate is handled in bulk as frozen product and most main end-users have their bulk reception systems. Consequently, the small producers of concentrate have difficulties to compete with the existing Brazilian infra-structure.

3.4 In 1988 about 59 percent of all fruit juice imports in the world were orange juice concentrate, amounting to US$ 2,291 million, equivalent to about 1.8 million tons concentrate.

3.5 The Brazilian orange juice concentrate exporters are moving the price of concentrate up and down depending on their assessment of their own production possibilities and the global market situation.

Early 1990 the price for 65°Bx concentrate was as high as US$ 2,400 per ton, to be down to US$ 1,800 - 1,900 per ton in October 1990. Further price drops are expected, but the market would most likely stabilize at US$ 1,500 - 1,600 per ton.

3.6 Traders are looking for alternative sources for orange juice concentrate, to act as a counter balance to the Brazilian producers / processors. However, the well established infra-structure by the Brazilian processors and distributors make it difficult for other suppliers to break into the market.

3.7 Prices paid for frozen concentrate of orange juice have been as follows:

	US$ / ton FOT Europe
January 1987	1,375
December 1987	1,900
January 1988	2,100
December 1988	2,250
January 1989	2,250
December 1989	1,400
January 1990	2,450
August 1990	2,250
September 1990	2,050
October 1990	1,800

Grape-fruit Juice

3.8 Most of the grape-fruit juice (80 percent) produced in the world is relatively acid with a 5.5 - 7.5 ratio (sugar / ascorbic acid) which makes the juice not well suited for straight juice, but mainly for nectars in which more sugar can be added.

3.9 The grape-fruits grown in Jamaica could well be of the better quality, which has a high sugar content: a 7.5 - 10.0 ratio. This juice is well suited as straight grape-fruit juice with a good world market demand.

3.10 Price levels for 60°Bx concentrate are about US$ 1,600 - 1,800 per ton FOT (free on tank) Europe.

3.11 Main market for grape-fruit concentrate is USA.

Lemon Juice

3.12 A large part of the lemon produced is processed not only for its juice but also for lemon oil and the peel, used for pectin.

3.13 Lemon oil is paid about US$ 17 per kilo, a low price level has been US$ 14/kilo. The lemon oil is manufactured through cold pressing and mechanical separation (centrifugal separators).

3.14 Lemon juice concentrate is at present paid US$ 1,600 per ton for 45° Brix C&F Rotterdam. The price has been down to US$ 1,100 per ton.

Pineapple Juice

3.15 Main part of the pineapple juice concentrate is produced in Thailand, the Philippines, Kenya and South Africa. The total demand for pineapple juice has increased the last few years. The production of pineapples has dropped, however, due to crop failures, which have pushed the price for concentrate up.

3.16 Main markets in Europe for pineapple juice are Germany, Italy and Spain. Prices during the last few years have varied for 60° Brix concentrate from US$ 2,000 per ton down to US$ 700 per ton. Most likely prices would stabilize around US$ 1,200 - 1,300 per ton.

3.17 Pineapple juice concentrate is normally frozen since long term storage makes the product to go brown.

Mango Juice / Pulp

3.18 Mango represents a large number of different qualities, such as the high quality Alfonso from India, to low quality from a number of production places all over the world.

Total world production of mangoes is about 15 million tons.

3.19 Different mango types come out through processing quite differently. Consequently, it is important to start processing in a small scale to find out final results and market preferences. One variety of mango (Magdalena) grown in the area is said to be as good as Alfonso.

3.20 Main part of the processed mango goes into baby food and yoghurt. Baby food manufacturers prefer single strength pulp which is frozen.

Traded mango pulp should be of 13-16° Brix.

3.21 The market for mango pulp is not as large as for citrus and pineapple, but the consumption increases steadily and the price variations are rather small.

World trade in mango pulp is about 25,000 tons of which a good part goes to the Gulf States. EEC imports about 1,800 tons per year (mainly to UK and Holland).

3.22 Prices paid vary very much with the quality. Import prices to USA show an example (US$ ton):

Mango pulp from Dominican Republic:	US$ 470
Mango pulp from the Philippines:	US$ 900
Mango pulp from India:	US$ 1,680

USA imports about 1,600 - 1,800 tons per year.

3.23 Mango juice (mango pulp passed through fine screen) is sold mainly to the Gulf States. Saudi Arabia about 15,000 - 25,000 tons annually.

Passion Fruits

3.24 Passion fruits are relatively easy to grow and the plants carry fruit one - two years after plantation. Quantity produced and prices vary quite a lot, and the market is somewhat hesitant to go too heavily into products which have a higher level of passion fruit juice.

3.25 Prices per ton can vary between US$ 6,000 down to US$ 2,000 per ton of 50°Bx. At present the prices are relatively high. Some passion fruit juice is sold not concentrated, which makes national statistics somewhat unreliable.

3.26 In 1988 the export of passion fruit concentrate was as follows:

		Tons
Brazil		7,512
Peru		2,032
Sri Lanka	about	300
Colombia	about	3,000
Kenya		200
	about	13,000

3.27 Average FOB prices paid for Brazilian and Peruvian passion fruit concentrate have been:

	Brazil	Peru
	US$/ton	
1983	1,446	1,350
1984	1,844	1,410
1985	1,009	1,281
1986	1,492	1,[illegible]
1987	2,906	1,34[illegible]
1988	3,[illegible]	[illegible]

Guava Juice/Pulp

3.28 Demand for processed guava has increased the last few years; products such as juice and pulp.

3.29 The European market is mainly interested in buying single strength juice or low level concentrate of pink variety.

Price for juice (9° Brix) is about US$ 650 per ton C&F Europe up to US$ 750/ton for the pink/red varieties.

3.30 The volumes processed were in 1986 and 1987 as follows: (tons):

	1986	1987
South Africa	21,502	n.a.
Hawaii	7,708	8,122
Venezuela	3,160	10,927

3.31 USA imports guava paste and pulp from Brazil (2,424 tons in 1986), Dominican Republic (2,225 tons) and Australia (6,551 tons).

3.32 Guava juices have a rather limited market, because it is only used as a secondary juice in some fruit drinks.

Papaya Pulp

3.33 The EEC market is quite small due to low consumer preference

Papaya pulp is imported frozen and recently has been paid US$ 1,900/ton for 13° Brix

3.34 Costa Rica and Dominican Republic are exporting some papaya pulp to USA.

IV. MAIN OBSERVATIONS OBTAINED FORM THE TRADERS

The main recommendations made by traders visited are the following:

4.1 Market is expanding and long-term prospects are good.

However, price fluctuations are large, producer and trader have to work closely together to "take good times as well as bad periods".

4.2 Normal commission for a trader is 5%.

Some buyers / traders also take possession of the commodities.

4.3 A few traders could possibly invest 5-10% in the project.

4.4 Some traders prefer to work with frozen products because:

- easier to store for long periods;
- quality is higher;
- packing less expensive;
- aseptic processing needs very high hygienic conditions all through the plant, could be difficult during the first years.

4.5 Other traders prefer aseptic pack, because:

- small end-user could more easily handle the product;
- short term storage easy.

4.6 Traders are willing to work very closely with the project, but normally insist to be sole agent, and on long-term relationships.

THE INTERNATIONAL FRUIT JUICE INDUSTRY WITH SPECIAL REFERENCE TO TROPICAL JUICES

I. THE INDUSTRIAL USES OF TROPICAL JUICES AND PUREES

1.1 Over the past decade tropical fruit products have gained popularity all over the non-tropical world. But more than anywhere else interest has grown in the western European countries. Tropical fruits begin to appear in supermarkets and fruit markets as fresh fruit.

1.2 People today are more curious to try new products and many have travelled to exotic countries, where they have encountered the tropical fruits. Therefore tropicals are no longer unfamiliar products, but are increasingly being consumed both as a fresh fruit and as a processed material.

1.3 Thanks to their nutritious value tropical fruits are being consumed in many different forms. The most common way to process these fruits is to make a juice, a puree or a concentrate. Only ten years ago almost all trade of tropical fruit juices was in the form of single strength juice or puree. But high transport and storage costs have pushed international trade towards a greater handling of concentrated material. People in the fruit juice business say that the trade in single strength juice is just an expensive way to transport water around the world.

1.4 Still, during the concentration process some aroma is lost. Even though aromas are recaptured during the concentration and later added to the concentrate or the juice, a reconstituted juice does not have the same quality as a natural single strength. For this reason, there will always be some people that are interested in the single strength and would also be prepared to pay a relatively higher price.

Nevertheless, concentrated material is gaining in importance, and the constant development of finer processing equipment will enable the processor to produce a higher quality concentrate.

More than 80% of the tropical fruit juices imported to Europe is used in the beverage industry. The rest is used in the dairy industry in yoghurts, ice-creams, whey or similar products, or in other food stuff, such as marmalades, jams, baby food and candy.

II. THE BEVERAGE INDUSTRY

2.1 The beverage industry is the most important market sector for the offset of tropical fruit juices. Not only because beverages are consumed in great quantities, but also because the percentage of fruit juice as a raw material, is usually much higher than it is in other segments.

2.2 In the beverage industry, there is a great variety of different applications of the tropical juices and concentrates. They are used in juices, nectars, multi-fruit/multi-vitamin juices, fruit juice drinks, fruit drinks, dietetic drinks, syrups, liqueurs, soft drinks and many other types of beverages.

2.3 Markets and regulations vary in different countries. But as a general classification one can speak of the following types of beverages:

2.4 (i) On most markets a Fruit Juice for sale to the consumer must be 100% juice and contain no additives. In EEC 15 g of sugar can be added to one litre juice and it still remains a pure juice and the sugar does not have to be mentioned on the label.

(ii) A Nectar is composed of juice and water. But sugar and citric acid or lemon juice are added to boost the flavour. The amount of pure juice that has to be used in a nectar varies between 25% and 50% depending on the fruit. In EEC for example, the minimum juice content is 50% for orange and 25% for passion fruit and guava. Nectars were originally initiated by high fruit juice prices. By diluting the juice with water and boosting the flavour with sugar and acid the producer could still offer a fruit juice beverage at a relatively low price.

(iii) Fruit Juice Drinks, have a much lower juice content. Definition is not too clear, but normally the minimum juice content is 25%. In the fruit juice drinks a greater portion of sugar and citric acid are used that in nectars.

(iv) The Carbonated Drinks are actually juice added soft drinks. They contain 1-10% fruit juice and the content of sugar and citric acid are relatively high. The water is carbonated and the carbonated drinks are consumed as soft drinks.

(v) Soft Drinks contain no fruit juice at all. The flavour is obtained solely by flavouring compounds, sugar and citric acid.

2.5 The development in the beverage market is going towards a greater consumption of beverages with a higher juice content. The flavouring and compound houses that have supplied the soft drink industry, are moving into a new segment, where they also deal with fruit juices to be able to supply producers of carbonated drinks. Even though carbonated drinks have been existing in Europe for quite some time (for example the French "Orangina"), the big multinationals enter to this market, have really increased the consumption of carbonated drinks. PepsiCo's launch in 1984 of the lemon/lime 10% "Slice" was a powerful influence in getting this trend under way. In February 1986 Slice had caught as much as 12.5% of the American lemon/lime market in competition with products like Sprite and 7-Up. Later Coca Cola and Schweppes have also introduced carbonated drinks on the market and many other soft drink producers are now offering juice added soft drinks.

2.6 This trend towards a higher fruit juice content is based upon a higher quality consciousness of the consumer. This can be seen in the nectar market, where producers are increasingly changing to the production of juices. Some producers of fruit juice drinks will switch from sugar to a sweet apple or white grape and this will turn the drink into a nectar.

2.7 All in all the trend is evident that the beverage industry is moving towards a greater production of beverages with a higher fruit juice content.

2.8 A result of this development is also that a higher quality raw material is needed. The lower the fruit juice content, the easier it is to cover imperfections in the juice.

2.9 Multi-fruit/multi-vitamin drinks were introduced in Europe in the early eighties and have become very popular, especially in Germany. These are drinks with juices from usually ten or twelve different fruits. A carrying compound of usually orange, apple or pineapple makes up around 75% of the drink. This is used in order to get volume and liquidity. Lemon or lime is used to get the acidity and banana to get the body. The rest, up to 25%, supplies the character of the drink. This is usually the more expensive juices, like passion fruit, apricot, mango or guava.

2.10 Other juices are just used so that the producer can put ten different names on the label and they have no real significance for the character of the drink. Sometimes vitamins are added to the drink to increase the nutritious value further.

2.11 Some claim a juice content of 100% and are then sold as multi-fruit or multi-vitamin juices and others with a lower juice content are sold as multi-fruit or multi-vitamin nectars.

Tropical juices are increasingly being used in liqueurs and other alcoholic beverages as well.

III. THE DAIRY INDUSTRY

3.1 The dairy industry uses tropical juices, purees and pulp to produce yoghurt, ice-cream, sorbets, desserts, puddings, sauces etc. It probably absorbs about 10% of all imports of tropicals into Europe. Yoghurt is still the most important dairy product for tropicals, but ice-creams and sorbets are gaining in importance.

IV. OTHER FOOD INDUSTRIES

4.1 Other food industries produce jam, marmalade, jelly, baby food and other products. This section absorbs less than 10% of imported material. Yet, even in baby food the latest trend is tropicals.

V. THE TROPICAL FRUIT JUICE INDUSTRY - THE DISTRIBUTION CHANNELS

5.1 Tropical fruit juices are mainly imported into Europe and North America in the form of concentrate or a single strength juice. It is normally shipped frozen in a 200 kg drum or in a 200 kg aseptic bag-in-box.

5.2 For several reasons almost no juice is imported in a ready-to-drink package.

- Transport costs are higher;
- With the sugar added into the ready-to-drink beverage, a much higher duty has to be paid;
- Different food regulations on ingredients and labelling make it very difficult to produce a ready-to-drink product to be exported to many different countries.

This means that almost all tropical fruit juice is further processed in the country, where it is imported.

5.3 As mentioned earlier, most of the imported material is used in the beverage industry. In Europe there are a few important importers of tropical fruit juices. One of the most important is **Passi Ltd** in Rothrist, Switzerland, that opened up the European market for tropicals. They are probably the largest single importer of passion fruit and work with producers all over the world. Passi maintains a blending plant in Rotterdam from where it supplies its clients throughout Europe. Another important importer is **Eurocitrus** in Oosterhout, Holland. They make blends and bases that are sold all over Europe and to other parts of the world. Passi and Eurocitrus have recently come under the same ownership, but still operate as separate companies.

5.4 Cargil, further is a large producer of fruit juices. Their main product is orange juice, that they import in large bulk quantities, but they also deal with tropical juices and run some plantations of their own. Basically in Brazil.

5.5 Very often the importers, even if they are located in other countries, have their storage facilities in some of the large ports, like Rotterdam or Amsterdam. From there the goods, when sold, are transported by boat, rail or truck to the buyer.

5.6 Companies that use relatively small quantities of tropicals usually obtain their raw material through specialized agents or importers. Agents act on behalf of the exporter and receive a commission, ranging normally from 3 to 5 percent, for their services. Importers buy on their own account and usually carry stock. This means, that they carry the storage costs and also bear the risk of unsold goods and lower prices. On the other hand, they can profit from rising prices by speculating in goods to store. Many companies though, work both as importers and agents.

5.7 The compound houses play a significant role in supplying the soft drink industry and the dairy industry with bases and blends. They also often supply fruit bases for the production of baby food and other food stuff. Compound houses import significant quantities of especially mango products. Passion fruit is also used by these companies, but not to the same extent. Compound houses usually import their tropical material directly from the producer, but sometimes it is also obtained through agents or importers.

5.8 The large beverage companies normally obtain all or part of their needs direct from source. Although they may often also deal with agents. Larger beverage companies have direct contacts with exporters and their representatives render frequent visits to the latter's facilities.

ORANGE JUICE AND JUICE CONCENTRATE

I. PAST TRENDS

1.1 Production and Processing Rates. The United States and Brazil accounted for 49% of the world's orange production in 1986 (Table 1). Orange production in the United States and Brazil is pre-dominantly utilized to produce juice. Most of the production elsewhere in the world is utilized fresh. Producers of orange juice other than the United States and Brazil include Argentina, Australia, Chile, Cubas, Cyprus, Egypt, Greece, Italy, Israel, Japan, Mexico, Morocco, South Africa, Spain, Tunisia, Turkey and Uruguay.

1.2 In recent years, Florida's processed utilization rate has ranged from 92% to 94%. The frozen concentrated orange juice (FCOJ) yields in Florida have ranged from 4.8 to 5.9 42° Brix litres per box, with yields in the past few years being exceptionally high.

1.3 Brazil had nearly 145 million trees in 1987/1988, with about 20% of the trees being non-bearing. In comparison, Florida had about 55 million round-orange trees with 35% being non-bearing, according to the 1988 census. The high percentage of non-bearing trees in Florida is related to the ongoing post-freeze recovery.

1.4 Although Brazil has a much greater tree population than Florida, Florida has higher yields, both in terms of kgs of fruit per tree and litres of juice per kg. In Brazil, about 80 kgs of fruit per tree are normally obtained. In Florida 140-160 kgs of fruit per tree may be obtained, depending on variety. The data on quantity of 42° Brix FCOJ per box indicates that in recent years Florida has obtained yields of about 0.14 litres per kg, compared to 0.11 to 0.13 litres per kg in Brazil.

1.5 Fresh utilization in Brazil has ranged from 800,000 to 2,000,000 tons in recent years. Based on the average per capita fresh consumption in this decade and growth in the Brazilian population of about 2.2% per year, fresh utilization is expected to range from 1.4 to 1.8 million tons over the projection period of this study. For purposes of estimating orange juice production, processed utilization in Brazil is determined as total orange production minus fresh utilization.

1.6 Consumption. Import/export data for the United States indicates that over 90% of U.S. imports are normally from Brazil, with Mexico being the next largest supplier.

1.7 European orange juice imports are also dominated by Brazil (Table 2). The data in the table does not distinguish between FCOJ and orange base and, as a consequence, probably understates Brazil's actual dominance of the market (e.g., whereas most of the imports from Brazil are actually FCOJ, much of the imported product from Israel is probably orange base). The data, however, does appear to indicate that, although no single country outside the United States and Brazil is a major orange juice producer, the total production from these relatively small producing countries could be substantial.

1.8 Imports of orange juice per country in 1988 are shown in Table 3 (this table also includes grape-fruit juice).

1.9 The Swedish statistics show quantities imported without regard to the form of concentration. The statistics do not indicate how much juice is imported in ready-to-drink form or whether it is deep-frozen or canned. However, the very small domestic production of fruit juices - primarily apple juice and vegetable juices - can be ignored when estimating the total market.

Total imports in 1984 amounted to about 37,000 tons with a total value of SEK 397 million. Orange juice is still by far the most imported variety, constituting about 57% of the total value (Table 4).

The sale of juice is about 17 litres per person per year, while nectar has reached an annual per capita consumption of 6 litres.

Manufacturers use deep-frozen concentrates, primarily from Brazil, as raw material in their production. More than 60% of the juice and nectar is sold as concentrates, specially packed in aluminium foil coated paper cartons. Ready-to-drink juices show a declining trend, while deep-frozen juices have never been really popular in Sweden.

There are two large manufacturers. ARLA (a dairy organization owned by the Swedish farmers' cooperative) has half the market while BOB (owned by ICA) has about 30%. Juice in bigger packs is sold to the institutional market. In this sector, which accounts for about 15% of the total market, there is also a demand for juices aseptically packed in tins of 1 or 3 kg.

The second market segment is the food industry, using juices primarily for production of flavourings for soft drinks and other beverages, as well as various types of food products. It buys deep-frozen concentrates but also aseptically and chemically preserved juices, the latter bought in 200 kilo drums.

About 50% of Sweden's imported juice is processed and packed for the consumer market. The consumer market retail trade in Sweden is dominated by three big integrated organizations specializing in importing, wholesaling and retailing. **ICA** is an importing and wholesaling organization owned by individual retailers on a cooperative basis. A central body in Stockholm handles most of the import activities. Three regional companies with more than 20 distribution centres supply more than 4,000 ICA retailers. **BOB Industries**, the second-biggest juice packer in Sweden, belongs to the ICA group. It makes its own purchases from its head office in Kumla.

ICA also has an organization for selling to the catering market. It is estimated that the ICA group is responsible for about 30% of total food distribution in Sweden.

The consumers' cooperative, **KF**, which has 17 regional distribution offices supplying more than 2,000 cooperative food and department stores and other outlets. A special company, **PROMUS**, is a supplier to the catering market.

KF is also involved in the production of food and beverages through a subsidiary, **Foodia AB**, which also handles the import of most of KF's canned and deep-frozen products.

KF covers 25-30% of total food distribution in Sweden. The consumers' cooperatives in the Nordic countries have established a special body in Copenhagen, called **NAF**, which acts as a purchasing agent.

ÖNOS imports 600-800 tons of frozen orange juice concentrates annually with a growing share of the market. The company contacted Cuban trade organizations in 1985 for information about juice exports but did not receive any response at that time.

The larger manufacturers import fruit juices themselves but they also buy via specialized agents/importers. These importers, very often quite small companies, may be specialized in a certain product group or in selling to specific customers, e.g. caterers or industrial users. They are usually quite open to new product ideas and are interested in testing new suppliers.

All juices enter Sweden duty free according to the GSP scheme. Shipments are subject to testing by the authorities according to general international requirements. Special attention should be given to the regulation concerning the metal content of the product:

- the tin content may not exceed 250 milligrams/kilo;
- the lead content may not exceed 2 milligrams/kilo.

There are also special regulations as to the labelling of consumer packed food.

The industry requirements for orange juice are 65 Brix concentration with a pulp content of 6-8%. The ratio (acidity/Brix) should be 15 and the colour close to OJ3. Manufacturers generally prefer frozen concentrated juice to aseptically packed juice since there is no risk for involuntary fermentation.

II. PROJECTIONS

2.1 Projection methodology. In competitive markets, such as the orange juice market, the market price is determined through the inter-action of supply and demand.

2.2 The factors that influence the supply and demand for orange juice include:

- The orange tree population;
- Production yields;
- Exchange rates;
- Income growth and;
- Advertising.

Future orange juice production has been estimated by:

1) Projecting the orange tree numbers in different age categories based on initial tree populations, assumed tree-loss rates and estimated tree-planting levels;

2) Applying average yields by age of tree to the tree-number projections to find total orange production;

3) Estimating processed utilization based on the total orange production estimates and processed and fresh utilization trends and;

4) Translating the production utilized in processing into litres of juices by applying average juice yields.

The demand component of the model focuses on the U.S., Canadian and European [1] markets. The equation for each market relates quantity demanded to the FOB price, with an adjustment for the tariff level existing in the market. In addition, the quantity demanded is related to a growth factor reflecting the overall impact resulting from changes in population, income, advertising, substitution and other factors that affect growth. The growth factor used is consistent with average historical growth rates.

Given an estimate of production for any given year, the demand equations are used to estimate the market FOB price for orange juice. In turn, the market price is used to estimate on-tree prices which are then used to determine plantings.

[1] Belgium, Luxembourg, Denmark, France, West Germany, Greece, the Netherlands, Spain, the United Kingdom, Ireland, Italy, Portugal, Finland, Norway and Sweden.

Given current tree plantings and existing tree stocks, future production is estimated straight-forwardly as mentioned earlier. The dynamic relationships between prices, plantings and production allow consistency projections of orange juice production, allocations of supplies and market-clearing prices.

Prices. The estimated market-clearing Florida FOB price for FCOJ in terms of 1989 dollars is expected to be 3,000 per ton solids during 1989/1990, falling to $ 2,200 per ton solids in 1994/1995, and rising to $ 2,500 per ton solids by 1998/1999 (Table 5). Over the projection period, FOB prices vary in response to how fast orange juice supply grows relative to the growth in demand. In the first part of the projection period, the growth in supply is expected to outweigh the growth in demand, thus depressing prices; in the latter part of the projection period, the opposite is expected to occur, resulting in increasing prices.

The FOB price estimates were used to project grower on-tree prices. The estimates in Table 6 indicate that Florida growers can expect real on-tree prices in terms of 1989 dollars to range from $ 0.13 per kg to $ 0.09 per kg. Brazilian growers can expect real on-tree prices to range from $ 0.06 to $ 0.03 per kg over the projection period.

Plantings. Based upon the on-tree price estimates, Florida round-orange tree plantings are estimated to decrease from 5.0 million trees in 1989/1990 to 2.0 million trees in 1995/1996 and 1996/1997, and then increase slightly to 2.1 million trees in 1997/1998 and 1998-1999.

Brazilian orange-tree plantings are estimated to decrease from 10.3 million trees in 1989/1990 to 7.1 million trees in 1994/1995, and then increase to 9.3 million trees by 1998/1999.

Yields. Given the estimates of tree-planting rates in Florida and Brazil, the bearing orange-tree population in Florida and Brazil is expected to increase over the projection period, leading to increases in orange production. Florida round-orange and Temple production are estimated to increase over the 1989/1990 to 1998/1999 projection period from 6.8 million tons to 9.9 million tons, a 46% increase, based on post-freeze yields for the 1985/1986 through 1987/1988 seasons and expected yields

for the 1988 1989 season, and a 2.5% annual tree-loss rate for round-oranges (Table 7). Brazilian orange production is estimated to increase from 10.6 to 12.1 million tons over the projection period, a 14% increase, based on a yield of 85 kg per tree, the average for the 1979/1980 through 1987/1988 seasons, and an annual tree-loss rate of 4.6%.

Orange juice production. Orange juice production in the United States is estimated to increase from 3.7 billion litres to 5.3 billion litres single-strength equivalent (SSE) or 43%, over the 1989/1990 to 1998/1999 projection period (Table 8).

Production of orange juice in Brazil is estimated to increase from 4.4 billion litres to 5.0 billion litres SSE, or 13%, over the projection period, based on the assumptions that fresh utilization will range from 1.5 to about 1.8 million tons and that the juice yield will be 0.12 42° Brix litres of FCOJ per kg, the average for the period from 1979/1980 to present. Thus, total U.S. and Brazilian orange juice production is estimated to increase from 8.1 to 10.4 billion litres SSE over the projection period.

Orange juice demand. Demand by region for U.S. and Brazilian orange juice is shown in Table 9.

Based on the average historical growth-rate assumption, orange juice demand is estimated to increase over the projection period in the following way:

- US: from 4.8 to 6.2 billion SSE litres (a 28% increase);

- Canada: 0.5 to 0.7 million SSE litres (a 26% increase);

- Europe: 2.4 to 3.0 billion SSE litres (a 26% increase); and

- Rest of the world: 0.3 to 0.4 billion SSE litres (a 29% increase).

Overall, world demand is estimated to increase from 8.1 to 10.4 billion SSE litres (a 27% increase).

The demand projections are based on the assumption that the present structure of tariffs for orange juice remains in place in the key world markets. The United States, Canada and the European Economic Community all impose tariffs on orange juice imports. The tariffs range from 35 cents per SSE litres for FCOJ entering the United States, to a 19% ad valorem tax on orange juice entering the European Economic Community, to no tariff on FCOJ entering Canada.

Table 1

FEASIBILITY STUDY ON CITRUS JUICE PROCESSING
AND EXPORT MARKETING

Table 1. World production/processing of oranges a)

In'000 metric tons

	1986/87		1987/88		1988/89b)	
	Production	Processing	Production	Processing	Production	Processing
Brazil	11,374	7,548	11,160	7,507	NA	6,817
USA	7,485	5,374	8,181	6,008	8,860	6,482
Spain	3,223	327	3,749	258	3,241	230
Japan	2,604	647	3,008	832	2,544	587
Mexico	1,814	353	2,093	415	2,425	515
Italy	2,955	595	1,751	336	2,530	620
Egypt	1,352	11	1,521	12	1,510	14
Morocco	940	46	1,213	249	1,192	235
Turkey	1,050	105	980	98	1,070	107
Argentina	890	198	800	168	NA	NA
Israel	973	552	751	347	766	369
South Africa	625	172	625	160	NA	NA
Australia	500	278	585	314	NA	NA
Cuba	530	110	545	115	570	125
Greece	949	149	511	80	857	152
Other countries	560	49	457	27	NA	NA
Total	**37,824**	**16,541**	**37,930**	**16,926**	**NA**	**NA**

Note: a) Including tangerines

b) Forecast except for Brazil which lists raw material intake in Sao Paulo only

Source: FAS/USDA

Table 2

FEASIBILITY STUDY ON CITRUS JUICE PROCESSING
AND EXPORT MARKETING

Table 2. European Economic Community (EEC) - Imports of frozen concentrated orange juice. a,b)

Item	1985	1986	1987
	- - - - - - tonnes - - - - - -		
Total EEC Imports	503,856	685,575	687,690
Source			
Outside EEC			
Brazil	170,985	307,647	304,552
Israel	97,497	101,497	122,487
USA	11,699	9,554	26,343
Morocco	18,208	20,153	9,457
South Africa/Swaziland	909	737	1,372
Argentina	784	2,597	829
Cyprus	1,613	1,448	---
Spain	10,063	c)	c)
Other Countries	3,469	2,694	9,096
From EEC Countries			
Italy	25,273	15,884	19,424
Spain	c)	8,160	8,209
Greece	4,149	739	2,019
Other Countries	159,207	214,414	183,902

Notes:

a) Includes unspecified quantities of orange base.

b) Includes intra-EEC transactions.

c) EEC member as of January 1, 1986.

SOURCE: Foodnews, June 3, 1988 (EUROSTAT/National Statistics).

FEASIBILITY STUDY ON CITRUS JUICE PROCESSING
AND EXPORT MARKETING

Table 3. West European Fruit Juice Consumption *)

(1988-in million litres)

	Orange	Apple	Grape-fruit	Pine-apple	Others	Total
NETHERLANDS						
Juice	116	110	NA	3	11	240
Nectars	24	5	NA	NA	26	55
Juice drinks	10	NA	NA	NA	3	13
Total	**150**	**115**	**NA**	**3**	**40**	**308**
NORWAY						
Juice	30	2	1	1	NA	34
Nectars	1	13	NA	NA	10	24
Juice drinks	7	NA	NA	NA	4	11
Total	**38**	**15**	**1**	**1**	**14**	**69**
PORTUGAL						
Juice	**1**	**NA**	**NA**	**1**	**NA**	**2**
Nectars	1	NA	NA	2	7	10
Juice drinks	32	5	NA	7	19	63
Total	**34**	**5**	**NA**	**10**	**26**	**75**
SPAIN						
Juice	30	8	NA	20	62	120
Nectars	22	1	1	35	61	120
Juice drinks	32	3	NA	NA	19	54
Total	**84**	**12**	**1**	**55**	**142**	**294**
SWEDEN						
Juice	62	21	NA	NA	20	116
Nectars	7	1	NA	NA	32	40
Juice drinks	7	5	NA	NA	19	31
Total	**78**	**38**	**NA**	**NA**	**71**	**187**
SWITZERLAND						
Juice	100	23	8	NA	28	159
Nectars	9	NA	NA	NA	3	12
Juice drinks	NA	NA	NA	NA	42	42
Total	**109**	**23**	**8**	**NA**	**73**	**213**
TURKEY						
Juice	NA	NA	NA	NA	NA	NA
Nectars	7	NA	NA	NA	33	40
Juice drinks	NA	NA	NA	NA	NA	NA
Total	**7**	**NA**	**NA**	**NA**	**33**	**40**
UK						
Juice	546	84	53	39	47	769
Nectars	NA	NA	NA	NA	NA	NA
Juice drinks	401	NA	NA	NA	328	729
Total	**947**	**84**	**53**	**39**	**375**	**1,498**
WESTERN EUROPE						
Juice	1,883	963	125	99	513	3,583
Nectars	792	40	22	37	808	1,699
Juice drinks	1,486	659	23	19	2,127	4,314
Total	**4,161**	**1,662**	**170**	**155**	**3,448**	**9,596**

Note: *) Product definition - juice (100% juice content) - nectar (35-99% juice content) usually with added sugar - juice drinks (0-34%) juice content).
Source: Tetra Pak Rausing S.A. Switzerland

Table 4

FEASIBILITY STUDY ON CITRUS JUICE PROCESSING
AND EXPORT MARKETING

Table 4. Sweden - Imports of Orange Juice in 1984, 1985 and 1986

Country of Origin	1984 Quant. (tonnes)	1984 Value ('000SEK)	1985 Quant. (tonnes)	1985 Value ('000SEK)	1986 Quant. (tonnes)	1986 Value ('000SEK)
Unsweetened						
Argentina	15	144	-	-	-	-
Belg./Lux.	192	2,858	368	5,701	197	1,617
Bolivia	-	-	-	-	-	-
Brazil	12,325	155,493	9,841	150,620	13,150	99,338
Denmark	124	1,253	63	628	106	352
Fed Rep of Germany	312	3,624	578	8,562	285	2,797
Great Britain	29	351	-	-	161	563
Ireland	179	5,438	167	5,705	227	10,252
Israel	1,510	18,751	814	10,194	943	9,227
Italy	274	2,961	279	3,408	144	1,875
Netherlands	1,758	20,656	2,146	30,954	2,723	24,130
Spain	170	2,074	206	2,817	179	2,369
USA	1,180	17,622	867	15,914	997	12,126
Other	8	55	305	439	184	998
SUBTOTAL	18,076	231,280	15,634	234,942	19,276	165,644
Sweetened						
Denmark	256	2,475	331	3,208	356	3,439
Israel	-	-	-	-	-	-
Norway	-	-	-	-	-	-
USA	-	-	-	-	-	-
Other	20	146	17	270	22	313
SUBTOTAL	256	2,621	348	3,478	378	3,752

Source: Central Bureau of Statistics (SCB), Stockholm

Table 5

FEASIBILITY STUDY ON CITRUS JUICE PROCESSING
AND EXPORT MARKETING

Table 5. Estimated Florida FOB orange juice price for the 1989/90 through 1998/99 seasons

	($/Tonne)	
Season	Nominal a)	Real b)
1989/90	3,128	2,996
1990/91	3.084	2.841
1991/92	2,952	2,621
1992/93	2,819	2,401
1993/94	2,775	2,291
1994/95	2,797	2,203
1995/96	2,930	2,225
1996/97	3,128	2,291
1997/98	3,392	2,379
1998/99	3,723	2,511

Notes:

a) Estimated dollar price.

b) Estimated price in terms of 1989 dollar purchasing power; assumes a 4% annual inflation rate.

Table 6

FEASIBILITY STUDY ON CITRUS JUICE PROCESSING
AND EXPORT MARKETING

Table 6. Estimated on-tree prices for Florida and Brazil for the 1989/90 through 1998/99 seasons

Seasons	Florida		Brazil	
	Nominal a)	Real b)	Nominal a)	Real b)
	- - - - - - - - - - $/kg - - - - - - - - - -			
1989/90	0.13	0.13	0.06	0.06
1990/91	0.13	0.12	0.06	0.05
1991/92	0.12	0.11	0.05	0.04
1992/93	0.11	0.09	0.04	0.04
1993/94	0.11	0.09	0.04	0.03
1994/95	0.11	0.09	0.04	0.03
1995/96	0.12	0.09	0.05	0.04
1996/97	0.13	0.10	0.06	0.04
1997/98	0.15	0.10	0.07	0.05
1998/99	0.17	0.11	0.09	0.06

Notes:

a) Estimated dollar price.

b) Estimated price in terms of 1989 dollar purchasing power; assumes a 4% annual inflation rate.

Table 7

FEASIBILITY STUDY ON CITRUS JUICE PROCESSING
AND EXPORT MARKETING

Table 7. Estimated Florida and Brazilian orange production and tree plantings for the 1989/90 through 1998/99 seasons

Seasons	Production			Tree Plantings		
	a,b) Florida	c) Brazil	Total	d) Florida	e) Brazil	Total
	- - million tonnes - -			- - million trees - -		
1989/90	6.8	10.6	17.4	5.0	10.3	15.3
1990/91	7.2	10.8	18.0	2.9	8.6	11.5
1991/92	7.7	11.2	18.9	2.7	8.5	11.2
1992/93	8.1	11.5	19.6	2.4	8.0	10.4
1993/94	8.5	11.7	20.2	2.2	7.3	9.5
1994/95	8.8	11.9	20.7	2.1	7.1	9.2
1995/96	9.1	12.1	21.2	2.0	7.3	9.3
1996/97	9.5	12.1	21.6	2.0	7.9	9.9
1997/98	9.7	12.1	21.8	2.1	8.6	10.7
1998/99	9.9	12.2	22.1	2.1	9.3	11.4

Notes:

a) Includes round oranges and Temples.

b) Based on average post-freeze yields by age of tree for the 1985/86 through 1988/89 seasons, and 2.5% and 3.5% annual tree-loss rates for round oranges and Temples, respectively.

c) Based on 85 kg per tree, the average yield for the 1979/80 through 1987/88 seasons, and an annual tree-loss rate of 4.6%.

d) Based on estimated Florida on-tree prices shown in Table 5; Florida plantings are specified as a function of lagged on-tree prices and the size of the Florida tree population; the on-tree price estimates are based on estimates of the FOB price which equates supply and demand for Florida and Brazilian orange juice.

e) Based on estimated Brazilian on-tree prices shown in Table 5; Brazilian plantings are specified as a function of the lagged Brazilian on-tree price relative to the price of sugar cane; as mentioned in footnote b, the on-tree price estimates are based on estimates of the FOB price.

Table 8

FEASIBILITY STUDY ON CITRUS JUICE PROCESSING
AND EXPORT MARKETING

Table 8. Estimated U.S. and Brazilian orange-juice production for the 1989/90 through 1998/99 seasons

Seasons	U.S. a)	Brazil b)	Total
	- - - - - billion SSE litres - - - - - -		
1989/90	3.729	4.415	8.144
1990/91	3.912	4.506	8.418
1991/92	4.165	4.650	8.815
1992/93	4.385	4.810	9.195
1993/94	4.594	4.893	9.487
1994/95	4.775	4.965	9.740
1995/96	4.938	5.007	9.945
1996/97	5.090	5.010	10.100
1997/98	5.230	5.007	10.237
1998/99	5.352	5.003	10.355

Notes:

a) Florida, California and Arizona production; Florida production is based on the estimate of round-orange and Temple production as shown in Table 6; assumes 92.1% of total Florida round-orange and Temple production is used in juice production, the estimated post-freeze average for the 1985-86 through 1988-89 seasons; assumes a Florida yield of 1.49 42^{o} Brix litres FCOJ per box, the post-freeze average as reported by the Florida Processors Association.

b) State of Sao Paulo production; based on orange production shown in Table 6; processed utilization is estimated as total orange production minus fresh utilization which is estimated to range from 1.5 million tonnes in 1989/90 to 1.8 million tonnes in 1998/99; assumes a yield to 0.12 42^{o} Brix litres FCOJ per kg.

Table 9

FEASIBILITY STUDY ON CITRUS JUICE PROCESSING
AND EXPORT MARKET

Table 9. Estimated orange-juice demand by region for the 1989-90 through 1998/99 seasons. a)

Seasons	U.S.	Canada	Europe	Rest of the World	Total
	- - - - - - - billion SSE litres - - - - - - - -				
1989/90	4,882	534	2,414	315	8,145
1990/91	5,060	553	2,501	334	8,448
1991/92	5,276	580	2,615	345	8,816
1992/93	5,496	610	2,733	356	9,195
1993/94	5,670	629	2,816	371	9,486
1994/95	5,825	644	2,888	383	9,740
1995/96	5,954	660	2,941	390	9,945
1996/97	6,060	667	2,979	394	10,100
1997/98	6,155	671	3,009	402	10,237
1998/99	6,242	675	3,032	406	10,355

Note:

a) Assumes an implicit annual growth rate of 2.7% over the projection period and constant tariffs.

Table 10

FEASIBILITY STUDY ON CITRUS JUICE PROCESSING
AND EXPORT MARKETING

Table 10. Sweden - Imports of Grapefruit Juice in 1984, 1985 and 1986

Country of Origin	1984		1985		1986	
	Quant. (tonnes)	Value ('000SEK)	Quant. (tonnes)	Value ('000SEK)	Quant. (tonnes)	Value ('000SEK)
Argentina	28	118	-	-	-	-
Cyprus	-	-	-	-	-	-
Israel	178	1,515	157	1,452	196	1,768
South Africa	34	212	-	-	-	-
Spain	71	415	56	323	-	-
USA	101	859	-	-	-	-
Other	12	122	100	1,152	82	774
TOTAL	424	3,241	313	2,927	278	2,542

Table 11

FEASIBILITY STUDY ON CITRUS JUICE PROCESSING
AND EXPORT MARKETING

Table 11. World production/processing of grapefruit

(In'000 metric tons)

	1986/87		1987/88		1988/89	
	Production	Processing	Production	Processing	Production	Processing
USA	2,330	1,252	2,523	1,317	2,502	1,290
Israel	392	249	317	193	364	221
Cuba	250	45	284	50	300	60
Argentina	160	90	150	80	NA	NA
South Africa	121	39	115	35	NA	NA
Mexico	91	39	105	51	79	35
Cyprus	111	26	96	22	104	23
Australia	30	18	33	20	NA	NA
Brazil	27	22	29	24	NA	NA
Turkey	30	3	27	3	30	3
Other contries	57	7	49	7	NA	NA
Total	**3,599**	**1,790**	**3,728**	**1,802**	**NA**	**NA**

Note: a) Forecast
Source: FAS/USDA

Table 12. Prices for frozen concentrated grapefruit juice (June 1989)

Country of origin	US $/t
USA	1.700 fob/US$160 freight
Israel	1.700 c + f
Brazil	1.500 cif
Argentina	1.550 fob/US$20 freight
Cyprus	1.670 fob Rotterdam
Turkey	1.750 cif

Note: All 58° Brix, frozen, Ratio beginning with 6. American products are also judged on colour, beginning with 17 and ending with 20 as the best value.

Table 13

FEASIBILITY STUDY ON CITRUS JUICE PROCESSING
AND EXPORT MARKETING

Table 13. World production/processing of lemon

(In'000 metric tons)

	1986/87		1987/88		1988/89a)	
	Production	Processing	Production	Processing	Production	Processing
USA	986	561	712	296	783	362
Italy	813	150	660	160	750	180
Spain	613	65	760	70	608	75
Argentina	440	300	370	240	NA	NA
Turkey	250	325	220	22	280	28
Greece	168	22	89	8	140	25
Chile	64	--	68	--	NA	NA
South Africa	66	34	60	25	NA	NA
Uruguay	40	--	48	--	NA	NA
Australia	39	20	47	24	NA	NA
Cyprus	54	10	46	6	51	7
Israel	69	39	43	20	41	18
Brazil	16	16	16	16	NA	NA
Mexico	9	9	9	9	9	9
Other countries	37	--	36	2	NA	NA
Total	**3,664**	**1,251**	**3,184**	**898**	**NA**	**NA**

Note: a) Forecast

Source: FAS/USDA

Table 14

FEASIBILITY STUDY ON CITRUS JUICE PROCESSING
AND EXPORT MARKETING

Table 14. EEC imports of lemon juice/concentrate

(In metrics tons)

	1984	1985	1986	1987	1988
West Germany	13,328	13,720	15,033	14,318	15,115
UK	7,947	7,947	7,165	7,585	7,913
Netherlands	4,256	4,193	6,168	6,155	5,536
France	4,611	5,209	5,263	5,198	4,822
Belgium/Luxembourg	1,913	1,435	1,980	1,671	1,588
Denmark	842	715	810	786	683
Italy	358	576	912	571	457
Rep. of Ireland	266	362	328	266	291
Spain	*	*	1,032	134	68
Greece	3	8	10	357	NA
Portugal	*	*	2	62	72
Total EEC	33,524	34,165	38,703	37,103	36,545
A) of which from non-EEC suppliers:					
Brazil	4,167	4,403	6,028	4,843	5,692
Argentina	4,065	2,974	3,303	4,644	5,312
Israel	1,933	2,114	2,538	2,426	1,669
Spain	682	1,072	*	*	*
USA	2,782	1,035	447	609	1,065
Mexico	513	401	104	259	328
Japan	598	261	--	--	--
Other contries	2,499	2,134	3,682	8,610	1,919
Total (non-EEC)	17,239	14,394	16,102	21,392	15,985
B) of which from EEC suppliers:					
Italy	9,231	12,011	12,076	11,574	11,913
Spain	*	*	1,364	1,365	1,932
Greece	1,082	1,188	1,359	964	578
Other(intra-EEC trade)	5,999	6,572	7,802	7,489	6,137
Total (intra-EEC)	16,312	19,771	22,601	21,392	20,560

Note: * Included in other countries
Source: EUROSTAT

Table 15

FEASIBILITY STUDY ON CITRUS JUICE PROCESSING
AND EXPORT MARKETING

Table 15. Prices for lemon juice concentrate (June 1989)

Country of origin	US $/t
Argentina	950, fob
Brazil	950, cif Germany
Greece	1.100, cif Germany

Note: All prices for lemon juice concentrate pulp 300-400 grammes per litre.

GRAPE-FRUIT JUICE AND JUICE CONCENTRATE

I. CONSUMPTION

1.1 Fruit utilization. Out of the 3.7 million tons of grape-fruit grown in major producing countries throughout the world, around 50% are processed industrially. Canned segments, juices and concentrates are the main products which are traded internationally. While there are certain markets to show expansion in grape-fruit juice consumption, high raw material prices - which tend to follow the pattern shown by orange juice - have restricted sales in recent years.

1.2 Consumer categories. Very much secondary to orange, grape-fruit juice, because of its slightly bitter taste, does not generally have a strong following among young consumers. Its loyalties lie mainly among the very health conscious and the more mature age group. It remains a fairly stagnant seller with any gains in certain markets offset by losses in others.

1.3 Past trend. In the USA, the world's largest producing and consuming market, purchasing has shown a continued decline over the past decade. High retail prices have been a major contributor to this development. In Europe, some positive trends are showing up in France and Italy but the UK, once the largest European consumer of grape-fruit juice, has been static (Table 3). Imports of grape-fruit juice to Sweden are shown in Table 10.

Future prospects. The outlook is not promising unless raw material prices conform to a less volatile pattern. Grape-fruit juice now has to compete in markets with many other flavours which, because of their wider sourcing range, are more favourable and stable in price. Whereas orange seems to have a remarkable capacity of recovery, once prices for orange juice come down again, grape-fruit juice loyalty does not appear to carry the same strength.

II. PRODUCTION

2.1 Past trend. As in all food commodities the wider the range of supply sources, the less likelihood of sharp fluctuation in raw material prices. In grape-fruit, the world scene is largely shaped by supply from the USA and Israel (Table 11).

2.2 Large production in USA has been mostly for the domestic market, but exports are taking on a bigger role as supplies are increasing. Out of a total 1987/1988 processing of around 92,000 tons in Florida - America's main producing region - only around 12,000 tons of frozen concentrated grape-fruit juice were exported. Canada and Japan were the main destinations. Sales potential in Europe has in past years been restricted, due to competition from Israel.

2.3 For the Europeans, Israel has traditionally been the main source of supply - far ahead in volume of USA, Brazil, Argentina, Cyprus and South Africa. Higher import duties for goods from some of these origins, together with more expensive shipment costs, have given the industry in Israel easier access to the European market in the past.

2.4 However, rising export prices from Israel have reached a level which other "third" country exporters are now able to undercut. Shipments from the USA in particular have picked up considerably during 1988.

Future developments. The Florida region is forecasting significant crop expansion in the years ahead. Future grape-fruit production is projected to rise from 2.3 million tons in 1989/1990 to 2.7 million tons in 1998/1999. Supplies of pink seedless fruit are likely to show the biggest expansion whereas production of white seedless grape-fruit is expected to grow at a slower rate.

Prices

The price of frozen concentrated grape-fruit juice is currently (June 1990) around $ 1,600 per ton FOB Rotterdam.

LEMON JUICE AND JUICE CONCENTRATE

I. PRODUCTION

1.1 Global production of lemons has ranged between 3.2 million and 3.7 million tons in recent years (Table 13). Slightly less than one third of the production is processed. Roughly 90% of the production is harvested in USA, Italy, Spain, Argentina, Turkey and Greece.

1.2 Although South Africa, Israel, Brazil and Mexico are relatively insignificant in terms of present production of lemons, a high proportion of crops in these countries goes into processing, largely for export.

II. TRADE

2.1 Current situation. There are three key participants in the world trade for lemon juice concentrate (LJC) - Argentina, Italy and USA. Combined, they account for around 80% of all the lemons processed in the world. While the US industry produces largely for its domestic market, Argentina and Italy have become leaders in the export trade.

2.2 Although Spain is now the third largest producer, the main emphasis has been on the marketing of fresh fruit. Recent years, however, have shown a growing trend towards Spanish processing to alleviate supply pressure in the fresh market.

2.3 Future development. With the approach of full EEC integration and equal access terms as other producing members, Spain's future role in the LJC sector is predicted to increase. Any future expansion by the Spanish industry will lead to stronger competition within Community markets and for "third" country exporters.

III. CONSUMPTION

3.1 Despite its large production - mainly by the industry in California - the US market continues to import, with Argentina being the main supplier.

3.2 Similarly in the EEC, where Italy takes a high share of the business, followed by Spain and Greece - supplies from outside sources are still required. Full year 1988 import figures for the EEC (excluding Greece, where the figures are still not available) show a slight fall in total trading - from 37,000 tons in 1987 to 36,500 tons last year (Table 14). Roughly 6,000 tons of this was intra-EEC business, the remaining 30,500 tons being "genuine" imports. "Third" country imports - at 16,000 tons - outweighed supplies from EEC processors which totalled 14,500 tons last year.

As indicated in Table 12, Italy is the single largest source, with close to 12,000 tons in 1988. Next comes Brazil with 5,700 tons followed by Argentina (5,300 tons) and Israel (1,700 tons).

IV. PRICES

4.1 The price for lemon juice concentrate (June 1989) ranges between $ 950 - 1,100 FOB Rotterdam for 400 gpl (gram per litre) of pulp quality (Table 15). However, the recent drought in Argentina has caused prices to firm to $ 1,250 and above.

PINEAPPLE JUICE AND JUICE CONCENTRATE

I. INTRODUCTION

1.1 The market for pineapple juice has been growing rather steadily during the 1980's. The market is known for it's prices being more sensible to supply fluctuations than to differences in demand. On the whole, production has met demand and prices have been stable during the 1980's. These two factors, price and demand, are also influenced by variations in the prices of other fruit juices. Since the pineapple juice market is stronger, fluctuations have though been less pronounced than for the total fruit juice market.

1.2 During 1988 and the beginning of 1989 there was an over-supply of pineapple juice on the world market. This trend has now reversed, mostly due to climatic problems in the two major exporting countries, Thailand and the Philippines. This has led to a reduced supply and difficulties to meet the growing demand on the main export markets to US and Europe. This, in addition to the import liberalisation in Japan and South Korea and the new and unexploited markets in Eastern Europe, means that prices are firm and may even rise. This is likely to happen, as Japan is willing to pay more than the traditional markets are.

It appears as if trading in concentrated pineapple juice is growing, at the expense of single strength juice. In some countries it is common to sell pineapple juice in mixtures with other fruit juices.

II. PRODUCER MARKETS

2.1 Thailand and the Philippines are the major producers and exporters of pineapple juice. They account for about 80% of annual exports, most of which is destined to the US market. Other important producer / exporting countries are Brazil (with a strong position in Europe), Kenya, the Ivory Coast, South Africa and Mexico. Australia is also a large producer, but although its export of single strength juice is substantial, most of the production is consumed domestically. Malaysia is another country to count on in the future concerning pineapple juice.

Producers/Exporters of Pineapple Juice and Concentrate, in metric tons

	PRODUCTION			EXPORTS		
SINGLE STRENGTH JUICE	1986	1987	1988	1986	1987	1988
Philippines	45300	46200	46800	29702	30423	31000
Cote d'Ivoire	4599	4870	4700	2545	2800	2700
Australia	27998	28181	29500	1588	2355	2300
South Africa	3124	1772	1500	2619	1566	1200
Kenya	1097	900	890	927	850	860
Malaysia	1100	1220	1340	578	589	700
Taiwan	4500	2700	2160	279	523	150
Mexico	6740	6740	6250	132	31	80
TOTAL	94458	92583	93140	38370	39137	38990

CONCENTRATE*	1986	1987	1988	1986	1987	1988
Philippines	36240	36960	37440	29836	31894	33500
Thailand	24000	29500	31000	23392	28221	30000
Kenya	8031	7910	7850	8000	7627	8500
Mexico	1465	2650	2150	1190	2420	1920
South Africa	3251	4391	5200	3334	3829	4500
TOTAL	72987	81411	83640	65752	73991	78420

* Average Brix level is 61°
N.B. The figures for 1988 are forecasted
Source: FAS/USDA

III. PRODUCER PRICES

3.1 The price of pineapple juice concentrate is more sensible to changes in supply than in demand. This has been evident the last year, when many of the most important producers/exporters have had raw material shortages. The prices of pineapple juice concentrate have thus increased considerably only since last year. Standard quality pineapple juice concentrate was sold at US$ 900/ton CIF in 1989, but has in one year almost doubled in price. This is due to raw material shortages, which have also caused delivery delays from the Thai pineapple industry. Earlier this year a few contracts were signed, stating prices between US$ 1,200 - 1,400/ton C&F with delivery during the last three months of the year. Brazilian prices fluctuate, but the average is about US$ 1,600/ton C&F for 60° Brix. Also South Africa has had production problems, which of course have raised their prices as well. For contracted deals the price for 60° Brix is US$ 1,400/ton C&F, compared to US$ 900 in October last year. The prices for spot supplies would be about US$ 1,550 - 1,650/ton C&F. Since the prices are almost always in US dollars, the exchange rate of this currency is of great importance for exporters as well as importers.

The prices of pineapple juice concentrate can be compared to those of frozen orange and frozen grape-fruit juice concentrate. The price of orange juice concentrate increased during 1987 - 1988, but experienced a big drop during 1989, when prices came down to about US$ 1,600/ton. As for grape-fruit juice concentrate the main exporter Israel received US$ 1,800 - 1,850/ton.

IV. CONSUMER MARKETS

The North American Market

4.1 Together with orange, apple, grape, and grape-fruit, pineapple is among the most popular flavours of fruit juices in the US. During the last three years the pineapple juice market has been stable. The volume sold through retailers is on the average 26,000,000 gallons, at a value of about 102 million USD. Imported single strength juice is sold by the retail sector, while concentrated juice most often is processed and used as an ingredient of mixed fruit juices. As for Canada, pineapple juice is less popular than in the US. It is usually sold in a single strength and single flavoured form.

4.2 The market is dominated by the two American multi-national companies Castle & Cooke Inc. and the Del Monte Corporation, which both have canning facilities in Thailand and the Philippines. The major part of the exports of pineapple juice thus come from these two countries. In addition, pineapple juice is produced in the state of Hawaii.

4.3 US Major Supply Sources of Pineapple Juice Concentrates, in metric tons

	1985	1986	1987
Philippines	19212	18566	22834
Brazil	5333	3871	
Thailand	15062	18598	
Mexico	1201	5980	8685

Source: National Statistics

4.4 The market is very label conscious and demands high quality, as it is one of the world's most food safety conscious markets. An example of this is the great fall in apple juice sales in the US last year, due to rumours about Alar-treated apples being harmful. This had a positive influence on the sales of other fruit juices.

The pineapple juice market is also affected in other ways. When, for example, the price of orange juice rose sharply in the US during the first half of this year, consumers reacted by turning to other flavours, among them pineapple.

The EEC Market

4.5 For natural reasons, pineapple juice has to be imported into the EEC countries. The major suppliers are Thailand, Brazil, Kenya and the Philippines, and in addition South Africa, which has boosted their sales since 1987. The UK has traditionally been the biggest market, but has now been surpassed by the South European countries. At present there exists in the EEC different duty rates for different exporting countries. However, these will probably change after 1992, with the inner market of the EEC. Therefore, exporters have to pay attention to the development in Europe.

4.6 EEC Imports of Pineapple Juice Concentrate, in metric tons

	1985	1986	1987	1988	1989
Thailand*				12100	14248
Brazil	4590	5197	3559	8434	8507
South Africa	3592	4000	6325	6937	6560
Kenya	3220	4254	2630	7955	5752
Philippines	2461	4874	3799	4951	4702
Ivory Coast	1889	1875	2194	763	1080
Swaziland	1106	522	490	560	377
USA	368	101	431	667	314
Other non EEC	1962	2238	5464	4505	4869
Total non EEC	20154	25010	27268	46872	46409

* included under "other non EEC" prior to 1988
Source: National Statistics

The UK Market

4.7 Orange is by far the most popular flavour, but others such as apple, grape-fruit and pineapple are also doing well, just as different fruit juice mixtures. Nectars have recently been introduced into the UK and the market is fairly unexploited. Since Del Monte, the brand leader, has for the second time this year raised its selling price of orange juice in the UK (so far a raise of 20%), and other companies are likely to follow, it is very much possible that sales of orange juice will suffer, while the sales of other fruit juices will increase.

Imports of pineapple juice to the UK reached 14,784 metric tons in 1989, a 10% rise since the year before and almost 50% more than in 1987. The main suppliers to the UK market are the Netherlands, Kenya and South Africa.

UK Imports of Pineapple Juice Concentrate, in metric tons.

	1987	1988	1989
Netherlands	3539	3375	3480
Kenya*		3564	3226
South Africa	1601	2006	2216
Belgium/Lux	1023	1288	1812
Thailand	100	265	1263
Israel	1444	1167	1087
Philippines	144	57	90
Others	2046	1663	1610
TOTAL	9897	13385	14784

*included in others in 1987
Source: H.M. Customs & Excise

Total fruit juice drinks sales arrived at 900 million litres in 1989, which is equivalent to 14 litres per capita. The greater part of it is sold through retailers. The juice market is very much dominated by own label products, which account for 60% of the total retail sales per year.

One peculiarity of the UK market is the fact that a policy of equal pricing for the different flavours is adopted by most packers. The retail price level is about the same for all flavours, even if the raw material cost is much lower for e.g. apple. Orange prices have been fluctuating a lot during the last years, something which pineapple juice thus suffers from as well, despite its steady raw material prices. The UK packers claim that a change is about to come, but this has been said several times with nothing happening. There is thus reason to question this claim.

The French Market

4.8 Orange and apple juice are the most popular also in France, but apple is closely followed by both grape and pineapple juice. However, the sales increase is even larger for pineapple juice (23%) than for [illegible] (almost 3%).

France is now the largest user of pineapple juice in Europe, after having overtaken the UK last year. The market has grown uninterruptedly since the beginning of the 1980's and reached 25 million litres in 1989. The main import markets are the Philippines, the Netherlands, Belgium and the Ivory Coast, which traditionally has been strong, but has dropped quite a bit the last few years.

French Imports of Pineapple Juice Concentrate, in metric tons.

	1987	1988	1989
Philippines	1707	2493	3071
Netherlands	1262	1308	1816
Belgium	1835	1922	1616
Ivory Coast	2193	755	1335
Kenya	613	1344	1168
Brazil	166	409	349
Others	2735	2695	5474
TOTAL	10511	10926	14829

Source: Direction Nationale des Statistiques du Commerce Extérieur

Pineapple juice is sold mostly in single strength form, while the concentrated juice is used for reconstitution and as a basis for drinks and nectars, which are also common on the French market. Both types are also used in the flavouring industry, e.g. in yoghurt production. Most pineapple juice is sold through retail outlets, under the label of French juice/drinks manufacturers.

The Spanish Market

4.9 The Spanish fruit juice market is expanding rapidly, and pure fruit juices are taking over the position from nectars as the strongest seller. Between 1987 and 1988 pure juices fruit increased in sales by 72%. Spain does still not have a very high consumption of fruit juice per capita, compared to other West European countries, but the rapid growth indicates a big potential in market.

As for flavours the Spanish market prefers peach, closely followed by pineapple and orange. Pineapple juice accounts for about 27% of the sales of juices/nectars and is enjoying rising popularity. This is confirmed by the fact that the imported volume of pineapple juice concentrate doubled from 1987 to 1988, reaching almost 11,000 metric tons. The strong import demand for pineapple juice concentrate in Spain and in other South European countries make them willing to pay prices up to 25% higher than the North European ones.

Spanish Imports of Pineapple Juice Concentrate, in metric tons.

	1986	1987	1988
Thailand	506	1195	3892
Netherlands	118	1445	2322
South Africa	1072	1311	1294
Philippines	598	638	1221
France	0	0	1206
Brazil	393	231	755
Kenya	145	64	0
Others	1	137	143
TOTAL	2833	5021	10833

Source: Eurostat/Foodnews

The West German Market

4.10 Fruit juice and nectar consumption per capita in West Germany is relatively big, with orange and apple being the most popular flavours. Pure pineapple juice accounts for only a small part of the consumption, but the flavour is used for tropical fruit juice mixes, of which the sales have been increasing lately. One factor to take into account is the reunion of the two German states, which will enlarge the market.

The EFTA Market

4.11 As in many other countries the EFTA market (Sweden, Norway, Finland, Austria and Switzerland) is having a rising import demand for fruit juices. Orange and apple are by far the two most popular flavours, but the latter is showing little import growth. Import demand for pineapple juice, however, is on the rise. Having augmented by on the average 16% between 1985 and 1987, the volume of imported pineapple juice concentrate was close to 2,200 metric tons in 1987.

Swedish Imports of Pineapple Juice Concentrate, in metric tons

	1985	1986	1987
Netherlands	275	615	321
USA	96	110	134
Philippines	151	98	133
Brazil	52	25	74
Israel	58	52	60
Others	167	256	560
TOTAL	799	1156	1282

Source: Statistiska centralbyrån

Norwegian Imports of Pineapple Juice Concentrate, in metric tons

	1985	1986	1987
Netherlands	59	17	40
Philippines	6	26	19
Kenya	38		
Others	70	56	62
TOTAL	173	99	121

Source: Statisktisk Sentralbyrå

Finnish Imports of Pineapple Juice Concentrate, in metric tons.

	1985	1986	1987
Israel	135	211	406
Brazil	221	184	78
Kenya	81	54	
South Africa	80		
Others	59	53	167
TOTAL	576	502	651

Source: Board of Customs, Helsinki

4.12 Conclusions

Thailand and the Philippines have since long been the most important exporters of pineapple juice concentrate. However, they have suffered from climatic difficulties during the last few years and have had problems meeting world demand. Other producing countries are taking advantage of the decreased production in these two countries and are thus gaining ground, e.g. South Africa and Malaysia.

The largest import markets are the US and the EEC, with its 320 million consumers. Except for domestic consumption, they buy for processing and re-exporting purposes. In Europe, the East European countries will be of a greater importance than before. In other parts of the world, new markets, e.g. Japan, Taiwan and South Korea, are opening.

The prices of pineapple juice concentrate depend mostly on the supply, but also on the prices of other fruit juices, where orange juice has the greatest influence. When the price of orange juice goes up, sales of other fruit juices rise. There is also reason to believe that prices of pineapple juice will firm somewhat during the 1990's, due to increased demand and a lower production.

Even though pineapple juice is ranked 4th or 5th among the favourite fruit juices in many countries, its growth rate is higher than many of its competitors. One can therefore have certain hopes that its market share will increase and thus better prospects for exporters can be expected.

PASSION FRUIT JUICE AND JUICE CONCENTRATE

I. THE FRUIT

More than 400 different varieties of passion fruit plants are known. Still only two of them are of commercial significance: "Passiflora edulis Flavicarpa" (yellow passion fruit) - mainly grown in South America, on Sri Lanka and on Fiji and "Passiflora edulis forma edulis Sims" (purple passion fruit) - mainly cultivated in Australia, Kenya, Angola and South Africa.

These plants prosper best in the geographical belt between 15° south and north of the equator. The yellow fruit is very adaptable to the hot and humid climate, whereas the purple better withstands the colder climates.

The bulk of world output used be of the purple variety. Mainly because Australia, which for many years was the leading producer of passion fruit, grows this variety. However, other countries have started commercial cultivation of the yellow type, and this variety has now become the preferred among fruit juice dealers in Europe. The fruit is also bigger than the purple type and gives a higher yield of fruit (up to 36 tons/ha compared to 28 tons/ha for the purple). Therefore, it is very well suited for commercial cultivation.

The passion fruit is also a labour intensive crop and this has resulted in the re-location of growing areas away from more developed countries to where cheaper manpower and acreage are more readily available. Today Australian production is basically consumed domestically, and Australia even imports some quantities from Fiji and Papau New Guinea, mainly to cover short falls in their own production.

Hybrids of the two varieties are found in most of the producing countries. One example is the passion fruit from Sri Lanka, that, in form and colour looks like the Flavicarpa, but which juice has the same flavour as the purple fruit. Also, seedlings have been brought to Brazil from Kenya in order to try a cultivation of the purple fruit. The result though, was that these plants gave a yellow fruit similar to the local Brazilian variety.

The commercially interesting varieties are thought to originate from north eastern Brazil, and its native Brazilian name "Maracuia" is often used throughout the world. In Germany, for example, "Maracuja" is the generally accepted name for a passion fruit.

The purple variety, though, is sometimes called "Granadilla" (the Spanish word for little granate apple - due to similaries in shape)

The passion fruit plant became known by Europeans in the 16th and 17th centuries, not because of its delicious fruits, but because of the beautiful flowers (passion flower). An Italian priest and botanist saw in the plant symbols of Christ's sufferings on the cross and gave the flower its name (Passion of Christ).

For centuries only the passion fruit flower was known in Europe. When commercial cultivation of the plant started in Australia, about 50 years ago, the fruit was virtually unknown in many parts of the world. But due to the many applications of the fruit and the excellent aroma of the juice, passion fruit has become one of the most popular tropical flavours throughout the non tropical parts of the world.

Australia carried out much of the pioneer work on primarily the purple variety and Australia today remains one of the few countries, where passion fruit is regarded as an everyday commodity.

The passion fruit is 5-8 cm long, 4-8 cm in diameter and oval in shape. It consists of a hard skin filled with juicy arillus tissue containing numerous seeds, which take up about 12 percent of the total weight. The juice is gained by separating skin and seeds. The yellow variety gives a slightly more acid juice than the purple does.

A yield of about 32% juice, that is very aromatic, makes the passion fruit one of the most interesting fruits. The intensity of the aroma would hardly be exceeded from any other fruit.

A drink with a portion of only 5 percent fruit juice still has an excellent aroma and a juice diluted with water 1:4 and sweetened with about 10% sugar has an aroma intensity equivalent to a pure orange juice. The flavour is so distinct that the juice can hardly be consumed in a pure juice form.

Harvesting normally starts the second year after plantation. The harvesting period streches over several months and flowers and fruit often exist simultaneously.

Both varieties are well suited for a number of different uses: Nectars, fruit juices, beverages, cordials, ice-cream, yoghurt, liquor, jam, etc.

The flavour of the red passion fruit is rather perfume like, whereas the yellow has a spicy touch. For a number of applications the two varieties are mixed.

The varieties have the following characteristics:

	Yellow	Purple
Colour of the seeds	Brown	Black
Average acidity	4%	3%
Average weight per fruit	60 g	35 g

The single strength juice has a Brix level of about 14-16° Brix, and concentrates are mostly traded at 50° Brix.

The juice of the yellow passion fruit is an excellent source of provitamin A and niacin, a good source of riboflavin (vitamin B_2), a fair source of ascorbic acid (vitamin C), but contains little or no thiamine (vitamin B).

The purple passion fruit is a good source of pro-vitamin A, riboflavin, niacin and ascorbic acid and a poor source of thiamine.

II. PRODUCTION AND TRADE

Apart from pineapple and mango juice (mango juice is sometimes also traded as puree or pulp), passion fruit juice is the only tropical juice traded in any greater quantities world-wide.

Today traded volumes are probably somewhat less than 25,000 tons of single strength equivalent, with Europe absorbing about 80% of traded material. Yet, this figure could have been much higher. The market growth has been slowed down by sharp supply and price fluctuations.

Originally only juice from the purple variety was demanded. By many it was considered superior in taste, but mainly it was the variety first introduced by the Australians and the variety handlers were used to. But due to occational shortages and price surges, Brazil began to export juice from the yellow variety, which became increasingly popular with reprocessors in importing countries. Today juice from the yellow variety accounts for the greater part of the international trade. The only countries offering the purple variety today are Kenya and in small quantities Australia, while the yellow variety is supplied by Brazil, Peru, Sri Lanka, Taiwan, Colombia, Ecuador, Venezuela, Fiji, Papua New Guinea and Israel. Also countries such as India, Malaysia and Thailand have either started to or have plans to supply passion fruit juice on the world market.

In the past decades, international trade in passion fruit juice has witnessed a dramatic rise, according to a report made by FAO in Rome ("International market situation for selected tropical fruit products") trade in single strength equivalent (14-16° Brix) was estimated to be of the order of 1,500 tons by the mid-seventies, 10,000 tons by 1980 and 15,000 - 20,000 tons by 1984.

Unfortunately trade in passion fruit juice is poorly documented. Only a few countries classify juice and pulp of passion fruit separate in their trade returns and often, no account is taken to whether a single strength or a concentrate is traded. This has led to fragmented statistics that are often very unreliable.

I table 1 export from some major exporters is shown.

Table 3.1 Exports of passion fruit juice from Brazil, Peru, Sri Lanka, Kenya and Fiji (in metric tons).

	1981	1982	1983	1984	1985
Brazil	4,786	7,784	6,909	5,115	3,265
Peru	2,749	1,024	623	2,392	3,437
Sri Lanka	1,951	2,870	1,494	444	n.a.
Kenya	318	487	336	329	n.a.
Fiji	207	193	n.a.	n.a.	n.a.

Sources: Food News - FAO of the United Nations

As mentioned, these statistics should be treated with a great degree of caution. For example, the fall from 7,784 tons in 1982 to 5,115 tons in 1984 for Brazil, does not necessarily mean a decrease in exported passion fruit juice. A switch from single strength juice to an increasing trade in concentrate may well compensate the fall in the statistics.

However, the trend is evident and it shows Brazil and Peru dominating the trade with Peru gaining in importance.

Passion fruit products (fruit drinks, cordials, jams, etc.) are very popular in many of the producing countries and a large part of the crop is consumed locally.

III. PRICES

It is obvious that violent price fluctuations have had a negative impact on market growth. Price fluctuations seem to move in cycles of four to five years.

Figure 3.1

Prices of single strength equivalent:

These fluctuations in price are mainly a result of changes on the supply side, and basically on changed supply of fresh fruit in the producing countries.

Passion fruit plants grow very quickly and give fruit the first year after plantation. Also, the plant normally gives fruit for only three years and new plants must then be replanted. This enables very quick changes on the supply side.

High prices of the passion fruit juice are normally caused by high prices of the fresh fruit. (An unusually high percentage of the passion fruit juice consists of the raw material price, i.e. the fresh fruit). The high prices attract new growers that start to plant passion fruit. Eventually an abundancy of fresh fruit will be produced and prices will fall. When prices fall the farmer will tear up his plants and plant an other crop, unless sales on the local market can be increased.

Market prices can vary somewhat in different parts of the world. The price of a 50° Brix concentrate is normally priced about US$ 100 higher in the US market than in Europe, as the European market is much more competitive.

When comparing the price of a concentrate (usually 50° Brix) with a single strength juice (14-16° Brix) many convert the single strength juice simply by multiplying it by 3.3 (50 divided by 15). This is not totally correct since a concentrate is priced relatively lower, usually about US$ 100 lower. A US$ 1,200 single strength juice would then be represented by a US$ 3,860 concentrate (1,200 x 3.3 - 100).

IV. THE MAJOR MARKETS FOR PASSION FRUIT JUICE

As mentioned earlier Western Europe absorbs about 80% of total international trade.

The following tables of exports from Peru, Brazil, Sri Lanka and Kenya also show the major importers.

Table 3.2

Exports of passion fruit juice by major supply sources: (in metric tons)

	1983	1984	1985
Brazil			
Netherlands	4,550	4,086	2,429
West Germany	644	149	318
South Africa	287	447	256
USA	159	83	203
Other countries	1,269	350	59
Total	6,909	5,115	3,265
Peru			
Netherlands	166	1,566	2,498
West Germany	11	326	258
USA	64	225	211
France	248	166	87
Other countries	134	9	383
Total	623	2,392	3,437

Sri Lanka			
Japan	79	183	
Netherlands	167	158	
Switzerland	1,020	39	
West Germany	208	18	n.a.
Other countries	20	46	
Total	1,494	444	

Kenya			
Netherlands	335	322	
Other countries	1	7	n.a.
Total	336	329	

Sources: Food News - FAO of the United Nations

All tables show the Netherlands as the major importer of passion fruit juice. It is important to remember though, that most of the Dutch imports are later re-exported to other markets in Europe.

West Germany, with a high per capita consumption of fruit juices and nectars, is the number one market for passion fruit juice in Europe. According to FAO they accounted for as much as 50% of total European consumption in 1984.

Outside Western Europe and the major producing countries, the only markets of some significance seem to be the United States and Australia. These countries both have local production of passion fruit. Australia mainly imports passion fruit juice to cover short falls in their own production. They import most of their material from Papua New Guinea and Fiji. In the United States (and Canada) total demand for passion fruit juice is estimated to amount to a little less than 3,000 tons of single strength equivalent. Part of these requirements are produced in Hawaii, but the area under this crop has declined and production is today less than 1,000 tons. The remaining requirements are imported from various sources in South America and also from Puerto Rico and Fiji.

Probably more than anywhere else market growth has been hampered in the United States because of unstable prices and supply. A consumption of only 3,000 tons is very low for such a large market with a long established tradition of fruit juice consumption.

The United States and Canada are markets with a large and untapped potential, but the North American companies want to be able to operate with long term prices and secured supply sources. In these markets a demand is easily created but it takes a great effort and large sums. Once a market is created these companies want to know that they have a secured supply of raw material. A producer, that is willing to set up a long term contract for part of their production is very interesting to the North American importers.

Smaller markets are also New Zealand and Japan, but in both countries there are quantitative import restrictions for passion fruit juice and the Japanese market is also heavily protected by high tariffs.

MANGO JUICE AND PULP

I. THE FRUIT

Mango (**Mangifiera indica**) is one of the most important and widely cultivated tropical fruits. For millions of people in India, mango is as common as apple and orange in northern Europe. Mango plays an important role in Indian stories and fables, and even today in India it is alleged to possess mysterious powers.

In the Middle East mango is also very appreciated. As a beverage, it is more common than almost any other fruit.

The mango tree grows wild in the Indian mountains, where they were grown more than 4,000 years ago. Still, the tree was not introduced to the western hemisphere until about 1700, when it was first planted in Brazil.

Mango is today cultivated in practically all tropical areas. India with an annual production of 5-7 million tons is so far the most important producer. A number of other countries within the tropical zone, but also in sub-tropical areas, produce great amounts of mango. There are more than 1,000 varieties of the mango fruit and they vary greatly in shape and character. The oval and often kidney shaped fruit weighs between 300 g and 1 kg. It has a green, yellow or red unedible skin that surrounds a juicy, yellow to orange flesh with a distinctive spicy flavour.

The trees are reproduced by grafting, because seed planting gives smaller and lower quality fruit. About 3-4 years after plantation the trees bear fruit. Trees from seedlings need 6-7 years before any fruit can be harvested. This is a fairly long time compared to other tropical fruits. The harvesting period, on the other hand, is fairly short. It varies between a few weeks and a maximum of three months. The wild mango fruit often has a strong turpentine flavour. Importers complain that sometimes material from India has too strong a turpentine flavour. The reason for this could be that too much of the wild mango is used in the production of the puree.

Most varieties of mango are an excellent source of provitamin A and ascorbic acid, as well as a fair source of all three B vitamins - thiamine, riboflavin and niacin.

A single strength mango puree has a Brix level of about 14° Brix.

The most highly appreciated variety is the **Alphonso** variety from India. It is sometimes called "the Rolls Royce of mangoes". This top-quality fruit is very much liked by the Europeans and is also priced higher than other varieties. Other well known Indian varieties are **Totapuri** and **Raspuri**. Among South American varieties that have gained popularity are **Haden** and **Chatorica**. **Tommy Atkins** is another well known South American mango, but not as appreciated.

II. PRODUCTION AND TRADE

Excluding pineapple, mango is the most important tropical fruit traded today, both processed and as a fresh fruit. The single most important producer of mango products is India. They produce the major part of all traded mango products and dominate the juice market in this segment.

Other producers are Taiwan, South Africa, Egypt, Pakistan, The Philippines, Sri Lanka, Thailand, Brazil, Cuba, Dominican Republic, Mexico, Peru, Israel and the United States (Hawaii and Florida). Trade in mango products is just as poorly documentated as that of passion fruit juice. The confusion is even greater since classification in "juice", "puree", "pulp" and "paste" is not clear. By definition, mango pressed without peel and stone is a puree. The clear liquid, with no solid particles, is the juice. Pulp is the solid material removed from the puree to make the juice.

In trade reports these classifications are not always followed. For instance, all material exported from India as pulp is actually puree. Customs tariffs are sometimes higher for purees, and mango is then traded as a juice to avoid these higher tariffs.

International trade in mango juice and puree is even more difficult to estimate than the trade in passion fruit juice. Mango is produced all over the tropical parts of the world and consumption is also more widely spread geographically.

From 1983 to 1985 India alone supplied between 17,000 and 26,000 tons of mango juice and pulp annually. This is the major part of international trade.

The Middle Eastern markets absorb estimately 25,000 tons of mango puree annually, most of which is produced in India. European consumption is approximately 6,000 tons, but only half of European imports are Indian material. The other half is supplied by South American producers (Peru, Brazil and Colombia).

III. PRICES

Generally, prices of mango juice and puree are much more stable than those of passion fruit juice. Mango trees have a longer cultivation period (four years), so supply is not changed as quickly.

One thing that should be remembered when looking at prices for mango, is that the quality of different materials differ greatly. Prices of US$ 600 per ton and US$ 1,400 per ton for two different materials can both be fair prices. The first price is for a mango which can not be marketed as the puree product, while the second price is for an excellent product suitable for juices, nectars or yoghurts. In other words, one can not simply compare prices of mango products as such, but has to examine the quality of the product, as well.

This makes pricing of mango much more difficult. However, there are certain varieties that are considered being of a higher quality, and normally material produced from a mixture of different varieties or the wild mangoes are considered being of a lower quality.

The Indian Alphonso variety is considered being of an outstanding quality, superior to all other varieties. A single strength Alphonso (15-16° Brix) is sometimes traded at prices as high as US$ 1,800 per ton C&F Europe, but prices normally range between US$ 1,000 - 1,400 per ton. Totapuri, another Indian variety, is not considered to be of as good a quality and prices range between US$ 800 - 1,000 per ton. (Out of the Indian production 30% is estimated to be of the Alphonso variety and 60% of the Totapuri variety).

Some Peruvian mangoes, Haden and Chatorica, are considered being of a good quality and prices range between US$ 800 - 1,200 per ton.

To get a good price the material should not be a mixture of different varieties. It should have the distinct flavour of a certain variety.

A double-strength concentrate is not priced twice as high as a single strength juice. A Peruvian concentrate (30-32° Brix) of a good quality ranges between US$ 1,200 - 1,600 per ton C&F Europe. This is because much of the distinctiveness of the material is lost during the concentration and its quality is not as high in the reconstituted form. But also, transport and storing costs are lower for a concentrate and these gains are to some extent taken by the importer and not solely by the producer.

IV. THE MAJOR MARKETS FOR MANGO MATERIAL

The major market outlet for mango juice and pulp is the Middle Eastern markets and the USSR. Saudi Arabia and Yemen are great importers of mango. In these markets mango as a beverage is second only to orange juice and is considered an every day commodity. The following tables of exports from India indicate the major market outlets for mango juice and pulp.

Table 4.1

Exports of mango pulp/juice from India (in metric tons)

Mango pulp	1982/83	1983/84	1984/85
Yemen	985	5,052	7,231
Saudi Arabia	5,210	3,721	6,271
Kuwait	979	793	1,369
United Arab Emirates	164	1,247	934
Netherlands	--	575	546
USA	391	316	251
Denmark	--	161	236
UK	446	595	233
Federal Rep of Germany	451	435	97
Other countries	6,104	658	649
Total	14,756	13,553	17,817
Mango Juice			
USSR	10,012	2,477	9,423
Yemen	25	713	24
Other countries	1,129	542	336
Total	11,166	3,732	9,786

Source: Food News

These tables show the Middle East and the USSR as the sole important importers. The figure for the Netherlands is surprisingly low since the total European market for mango puree, juice and pulp is estimated to about 6,000 tons of single strength equivalent and half of this, 3,000 tons, is supposely produced in India.

The North American market which is a small but growing market is estimated to a total of somewhat less than 500 tons

PAPAYA JUICE AND PULP

I. THE FRUIT

Papaya, (Carica papaya), also called pawpaw or papaw (should not be mixed up with the North American fruit "Pawpaw", Asimins triloba, that belongs to a different family), is alongside the banana the largest herb in the world. Because of its size and other similarities to a melon, the fruit is also known as "Tree melon".

Papaya originates from Central- and South America and was probably first cultivated in Mexico and Costa Rica. It is not known to grow wild, but is today grown in almost every garden in the tropical areas all around the world. Still, in Europe it is not very well-known, and only a small part of the papaya crop world wide is being processed.

The spherical to cylindrical fruit, 70 - 500 mm in length, sometimes weighs as much as 9 to 11 kg.

This large pear-like fruit has a yellow-orange to salmon-pink fruit flesh. The flesh has a buttery consistency.

The unripe fruit is green and turns to yellow-orange as it ripens. However, the fully ripened fruit is very sensible to pressure and is therefore harvested in the unripe yellow-green stage.

Papayas are usually grown from seeds. Their development is rapid, fruit being produced before the end of the first year. Under favourable conditions a plant may live five years or more. But already after two years the trees will give a diminishing yield.

Contrary to most tropical fruits, papaya has a low acidity content with a pH between 5.0 and 5.5. The flesh is an excellent source of ascorbic acid and provitamin A. But what makes the papaya interesting, is the content of papain. All parts of the plant contain a milk (latex) very rich in papain.

Papain is a protein cleaving enzyme which has many medical and industrial applications. One example is its detoxicating effect on the organism by toxic disturbances. Also as a digestive enzyme it is similar to pepsin but much more potent.

During the past years consumption of natural papain-preparations and papaya drinks has increased enormously. Especially in the USA and in Japan.

A single strength papaya puree has a natural Brix level of 11-14° Brix.

II. PRODUCTION AND TRADE

There is no statistical data available on papaya and internationally papaya puree is not traded to any greater extent. In Europe the total market is less than 1,000 tons. Yet, it is grown in almost all tropical areas of the world.

Prices of papaya puree are fairly stable compared to passion fruit. They range between US$ 600 - 1,000 per ton C&F Europe for a single strength puree.

Papaya puree is not consumed in any greater quantities in Europe and is not very well-known. It has a difficult flavour that is not appreciated by everybody. Still, papaya is used in many different blends and to some extent in the dairy industry. But in these blends papaya is not used because of its flavour but rather to get its exotic name on the label.

However, smaller quantities (100 - 200 tons) with a good quality could certainly be sold, if priced competitively.

ASEPTIC PROCESSING AND PACKAGING; GENERAL INFORMATION

I. TECHNICAL DESCRIPTION

1.1 Sterilization of food kills the bacterias and inhibits the enzymes. It is a more complete process than pasteurization which only kills a proportion of the bacterias.

The sterilized food can be kept for long periods, until mainly chemical reactions make the food no longer eatable. Sterilization is normally made by heat or sometimes by chemicals or radiation. However, it is not enough to only sterilize the food, the food item has to be kept isolated from further infections of bacterias which are present in the environment. If the food is already packed in such a way that reinfection can not be done after sterilization, the shelf-life is prolonged, otherwise packing of the food item has to be done in such a way that reinfection is prevented.

Packing under sterile conditions to avoid reinfection is defined as Aseptic Packing.

Aseptic processing and packaging is a process defined a follows: The product is continuously sterilized in a heat exchanger and then filled under sterile conditions into pre-sterilized containers.

1.2 Liquid or semi-liquid food can be sterilized and packed in two different ways:

(i) the food is packed into a container which is hermetically sealed and the container with its content is sterilized (normally with heat), See Chapter on Canning;

(ii) the food is sterilized and then aseptically filled into a sterile container. After the container is full, the aseptic sealing takes place.

1.3 The advantages and disadvantages with the two systems are as follows:

Sterilization of the food inside a container

(i) Heat-sterilization for non-acid food has to take place above 121°C (normally around 130-140°C). Containers have to withstand over-pressure (like a tin can) or if made out of plastic, the film has to be sufficiently strong at high temperature to withstand the over-pressure;

(ii) Plastic material can release, at high temperature, components from its composition which could be harmful to the consumer of the sterilized food;

(iii) Sterilization of large containers with food packed inside takes long time due to slow heat-transfer. Temperature differences which can be used have to be moderate, otherwise the food inside the container gets destroyed;

(iv) The advantage is that the process is simple. If the container is well closed and the heating is carried out properly and with enough time the food inside the container is sterilized and can be kept for quite some time.

In practice the system is used for canned items, and for liquids in glass bottles or jars.

Using glass the seal between the lid and the jar is an important weak point.

At present plastic bottles are also being used for milk and other food liquids.

Sterilization of the food and the container separately and the use of aseptic packing

(i) The individual sterilization of the food product and the container separately is normally not a problem, because the treatment can be designed to the specific need of the separate products;

(ii) The aseptic packing, that is filling the sterilized container with the sterilized food product under aseptic conditions is the complex part of the system. The technical design varies between a) systems for small containers, up to one to two like containers, and b) systems for large (bulk) containers, up to 1000 litres containers;

(iii) Aseptic packing can be done continuously, and is suitable for high volume production, as well as large containers. For containers, above about 20 litres content, the system of sterilizing the container together with its content, is normally not possible, due to very long heating time which destroys the nutritional value of the food. Consequently, the food product has to be sterilized before and filled aseptically into a pre-sterilized container.

Aseptic packing in bulk has been further developed during the last few years, and works at present with low default.

(iv) Due to processing at elevated sterilization temperature for a shorter time quality properties are less destroyed

than micro-organisms. This means that the process brings a higher product quality than regular canning.

1.4 Bulk containers

Aseptic filling in bulk containers did not expand until a few years ago, when a system of sterilizing large plastic containers with irradiation (gamma irradiation) was developed together with the safe system of filling the large bags under aseptic conditions.

The connection between the bag and the pipe with the product to be filled, has to be sterilized each time a new bag will be filled. Normally the sterilization is done by steam. The smaller the space to be treated between the sprout of the bag and the product pipe, the more efficient the sterilization can be done.

1.5 The bulk containers normally between 100 up to 1,000 litres have to be made of flexible plastic laminate, normally with aluminium foil to stop oxygen penetration. The film has to be strong and not break in wrincles.

To protect the bag, an outside container is normally used such as:

(i) steel barrel; efficient, but expensive and difficult to return;

(ii) cardboard paper boxes: less strong and expensive when not returned;

(iii) plywood boxes: foldable boxes, can be returned at reasonable cost.

1.6 The bulk packing system can handle liquid and semi-liquid fluids with or without pulp including pieces, as long as the pieces can be sterilized all through.

II ESSENTIAL PRE-TREATMENT PROCESSES

2.1 Products which are aseptically packed have to be sterilized before packing.

2.2 Sterilization of a food product is a function of the type of food to be treated.

Variables such as:

- acidity
- viscosity
- size of particles (if any)
- degree of contamination
- composition of food

all influence the effect of treatment needed to kill all micro-organisms.

2.3 Sterilization can be done with

- heat
- chemical treatment
- irradiation

Normally, for liquid / semi-liquid food heat-sterilization is used.

2.4 In order to avoid the change of the original food product, and to minimize the spoilage of vitamins and other ingredients in the food, the heat-sterilization is normally done at high temperature and short time (UHT-treatment = ultra high temperature treatment).

2.5 Two types of sterilizing systems are used for the UHT-treatment, where the liquid is sterilized in a continuous flow followed by aseptic filling. One method operates with direct steam injection of steam, the other one with indirect heating in heat exchangers.

2.6 In a UHT-plant the product is pumped through a closed system. The product is pre-treated, sometimes deaerated, sterilized at high temperature, cooled and then filled aseptically. Products are sometimes also homogenized before filling, either before or after the sterilization.

In the latter case, aseptic homogenization has to be provided for.

2.7 The intensive heat-treatment will sterilize the product. Absolute sterility is not possible. It is not possible to prove the absence of all living micro-organisms. The term, commercial sterility, is used instead. The definition is a product free from micro-organisms which grow and consequently contribute to the deterioration of the product.

Normally the process is calculated to reduce the number of organisms to 10^{12}. This figure is based on the necessity of Clostridium Botulinum.

2.8 Sterilization of milk normally takes place in a UHT-process at 140°C and at 3-5 seconds when the milk is treated directly with steam; or at 135°C and at 10-15 seconds when the milk is treated indirectly.

Fruit juices and purees can obtain commercial sterilization at a relatively low temperature depending on acidity. For example: orange juice normally is treated at 95°C during 20 seconds.

III CHANGES OF THE PRODUCT BEING PACKED ASEPTICALLY

3.1 The aseptic packaging process by itself does not change the product.

Two factors which influence the product quality is (i) the sterilization before the packing and (ii) the chemical reaction within the product during the storage period.

3.2 The heat-treatment during sterilization causes certain chemical reactions and other reactions take place:

(i) browning of the product. Can be avoided by shorter time and higher temperature;

(ii) destruction of vitamins. With efficient UHT-treatment the losses of vitamins are relatively low, since several vitamins are thermostable. Vitamins like vitamin C and B_6 and B_12 are normally reduced 3-5 percent in the UHT-treatment, depending on the temperature;

(iii) denaturation of proteins also takes place during the heat-treatment. In milk the whey proteins are partially denaturated, but the nutritional value is kept.

3.3 During the storage period following three main changes take place over prolonged storage time:

Browning

Browning in fruit juices as well as in milk occurs during the formation of pigmented compounds linked to organic chemical reactions mainly between sugar and proteins. The browning can also be related to enzymatic activities when poly phenol oxidase catalyses the oxidation of phenolic compounds which form brown or brownish red pigments.

It seems that relationship between the loss of ascorbic acid (vitamin C) and browning exists. In juice the vitamin C is slowly converted to compounds, which are dark and make the product to appear brownish.

Flavour changes

Over long-time storage the flavours change and can create off-flavours or flattening the flavours. Especially in citrus juices with high peel oil content the flavour changes can be a serious problem. The flavour changes are mainly due to chemical reactions.

Losses of vitamin C

Vitamin C can be decomposed by an oxidation reaction. The enzyme, ascorbic acid oxidase, accelerates the reaction, which can be controlled by reducing the oxygen content in the product as much as possible. However, high temperature during storage time speeds up the losses of vitamin C.

3.4 Other reactions during long storage periods could be:

* gelling and increase of viscosity;
* sedimentation; and
* separation of oil and other lighter products

Further, reactions may take place due to:

* interaction between the package material and components of the product;
* oxygen penetrating the package material during the long storage period.

IV MARKETS FOR ASEPTICAL PACKED PRODUCTS

4.1 Aseptic bulk packing of fruit / vegetable juices and concentrates makes the handling and transport relatively easy to carry out since the need for cold transportation and cold storage decreases. As mentioned above, the changes in the product increase with temperature increase, so in many cases the products aseptically packed are kept in cold storage and when possible also transported at as low temperature as possible (during nights) in order to maintain the quality as high as possible.

4.2 The international market for aseptically bulk packed fruit juice concentration as well as vegetable juices and purees has existed for many years. Originally it started with aseptically packed tomato pulp and paste packed in stainless steel containers, now the main trade is done with containers made out of plastic film laminates with aluminium foil. Aseptic packing is done for products both as juice/pulp and concentrate. Examples are:

* mango
* tomato
* pineapple
* passion fruit
* citrus
* banana

Prices are linked to the products with an additional cost for the plastic bag of about US$ 10 per 200 litre unit, and US$ 10-15 per box surrounding the bag depending on system used.

V SCALE OF OPERATION

5.1 The aseptic packaging systems are delivered as unit operations, with a set operational speed.

The normal packaging rate for commercial aseptic bulk packing systems is:

25 bags per hour per filling head;
bags of 200 litres/unit

5.2 Due to the relatively large investment costs in the sterilizer and the aseptic packaging system, the unit operation would have to operate normally at least one shift to be viable. The relatively long start-up period as well as the cleaning cycle at the end of the operation makes it necessary to operate at time spans of at least 6-8 hours. After operation periods of 10-16 hours it is normally advisable to stop the operation and carry out a cleaning-in-place (CIP) in order to get rid of any build-up of deposits in the sterilizer or in the aseptic packing system.

5.3 Commercially viable systems should normally have an annual through put of about 600-1,000 tons of bulk packing (200 litre containers).

VI INFRA-STRUCTURE NEEDED

6.1 The aseptic packaging systems, as said above, are operations which take relatively long time (30-60 minutes) to start-up. Consequently, any stop (even very short) in electricity, water, compressed air or steam can make the aseptic condition to break, and new start-up procedure is needed. It is very important when an aseptic system is installed, that utilities are available with high level of security.

6.2 Aseptic packing also need proper and clean environment with aseptic design and function, with regard to

* walls
* floors
* ceilings
* doors
* lighting
* ventilation

A separate room for the aseptic packing machine is advisable.

In general the environment has to be easily cleaned, proper acid-resistant tiles on walls and floors, well designed drainage and non-corrosive drainage system. The filling room should also have an over-pressure to avoid the infiltration of contaminated air. Incoming air should be passed through adequate filter.

6.3 The size of the room to house an aseptic filling machine for retail packages should have the following dimensions:

* 6 times 6 meters minimum

  height, about 4 to 6 meters depending on the type of machine

6.4 Aseptic bulk packaging equipment needs about the same space in order to facilitate the handling of filled containers around the equipment.

6.5 A skilled micro-biologist is required to be in charge of bacteriological control. A corresponding laboratory is needed.

6.6 The aseptic processing / aseptic filling plant is rather advanced and skilled labours and supervision are required.

VII MATERIAL NEEDED FOR THE OPERATION OF AN ASEPTIC PACKAGING SYSTEM

7.1 Packaging material

Several types os aseptic packaging system need tailor-made packaging material which only the equipment manufacturer can deliver. Consequently, it is very important that the supply of packaging material is secured on a long-term basis, when an aseptic packing system is installed.

7.2 Since the packaging material in most cases has to be imported (or its major components) the availability of foreign exchange is crucial. If any risk for shortage of foreign exchange is possible, the installation of an aseptic packaging system should be seriously questioned.

VIII TYPICAL INVESTMENT COST

8.1 Aseptic packaging machines are delivered by specialized manufacturers of packaging equipment. These manufacturers are normally not linked to the suppliers of sterilizers, which are enterprises specialized in heat exchangers and normally other dairy equipment. Consequently, with a specific filling machine, a range of different sterilizers could be applied. However, in order to have a complete package to work well, and with less guarantee problems, it is recommended to have one single supplier to handle the two unit operations.

8.2 The manufacturers of aseptic filling machines normally also are the supplier of the packing material. Packaging is tailor-made for the user of the aseptic filling machines. The tight relation between the packing machine and the retail packing material makes the price for the machine and the packing material linked together. A low priced aseptic filling machine could mean a higher price for the aseptic packing material.

8.3 A typical investment for a bulk aseptic packing system with a capacity of 25 bags and 200 litres per hour could be as follows:

Indirect heat treatment
(Hight temperature pasteurizer)

Consisting of:

- Two plate heat exchangers, or spiral heat exchanger
- hot water sets
- deaeration chamber
- vacuum pump
- centrifugal pump
- control panel US$ 200,000

Aseptic filling

Consisting of:

- aseptic tank to hold the product before filling - aseptic bulk filling system	US$	230,000
Installation / start-up	US$	21,000
Freight (average)	US$	70,000

Building space

Building space for the

- processing equipment about 130 m^2 à US$ 150/m^2	US$	19,000
- control room 200 m^2 à US$ 100/m^2	US$	20,000
- packing material 150 m^2 à US$ 100/m^2	US$	15,000
Total	US$	575,000

ESTIMATED INVESTMENT COSTS
(March 91)

	Unit	Unit Cost	Quantity	Total US$.
Rehabilitation of existing building:				
Floor tiles	m^2	110	900	99,000
Tiles on walls in process area	m^2	60	175	10,500
Ventilation	set	1,000	10	10,000
Doors/windows	set	20,000	1	20,000
New inner ceiling	m^2	40	900	36,000
Internal walls	m^2	100	300	30,000
Miscellaneous				50,000
Subtotal				255,500
Utilities:				
Installation of electricity	set	20,000	1	20,000
Installation of water supply	set	35,000	1	35,000
Boiler 500 kg/hour	set	40,000	1	40,000
Installation of steam/ condensate pipes	set	15,000	1	15,000
Miscellaneous				5,000
Subtotal				115,000
Chilled Storage (500 ton)				
Insulation (polyurethan 15 cm)	m^2	1,400	30	42,000
Doors	set	1,000	3	3,000
Compressor 30,000 kcal/h	set	36,000	1	36,000
Evaporator/Condensors	set	18,000	1	18,000
Forklift	pc	18,000	1	18,000
Other work	-	-	-	10,000
Subtotal				127,000

	Unit	Unit Cost	Quantity	Total US$
Equipment				
- Fruit reception and preparation	set	365,000	1	365,000
Polyfruit and finisher (2 ton/hr.)				
Mango destone				
Dicer				
Refiner				
Spiral heater and cooler				
- Adjustment station	set	129,000	1	129,000
Homogenize				
Pump				
Two tanks				
- Spiral pasteurizer	set	157,000	1	157,000
- Deaeration	set	46,000	1	46,000
- Bag in Box Filler	set	214,000	1	214,000
- Laboratory and Quality control equipment	set	23,000	1	23,000
Subtotal				934,000
Freight Training and Installation				
Packaging / Freight				83,000
Stainless steel installation material	set	65,000	1	65,000
Port clearance / domestic transport				6,000
Training (one month)				15,000
Installation supervision (one month)	-	-	-	17,000
Installation	-	-	-	10,000
Start-up	-	-	-	40,000
Subtotal				236,000

	Unit	Unit Cost	Quantity	Total US$
Vehicles				
Truck 5 ton	pc	22,000	1	22,000
Truck insulated with cooler	pc	34,000	1	34,000
Pick-up	pc	13,000	1	13,000
Subtotal				69,000
Office equipment				
Telephone installation	pc	5,000	1	5,000
Fax	pc	2,000	1	2,000
Computer/printer/typewriter	set	4,000	1	4,000
Furniture	set	2,000	1	2,000
Air conditioner	pc	1,000	1	1,000
Subtotal				14,000
Interest during construction				
6 months	%	13	1747	113,000
Working capital (initial)				
Raw material	ton	200	500	100,000
Drums	pc	19.5	1,400	27,000
Aseptic Bags/liner	pc	23.0	1,400	32,000
Other costs				50,000
				209,000
Total Base Cost				20,72,000
Physical Contingencies	%	10	2072,000	207,000
Price Contingencies	%	5	2072,000	104,000
TOTAL				2,383,000

Associations utilized when calculating the estimated investment cost.

- Exchange rate US$ 1.0 = J$ 8.0
- No customs will be paid on imports
- Existing buildings can be used, and will provide the shell for the processing plant. Work has to be done on floors and walls.
- Electricity and water would be available on the site. Connections and installation to the process building has to be done.
- New boiler will be installed.
- Chilled storage of 500 tons would be able to store two months final products in drums at a temperature around 0 degree Celcius. The storage would be divided into three chambers each 167 tons, to provide maximum flexibility.
- Equipment prices are based on budget quotations. Prices would vary pending on the final supplier selected.
- The installation and training would be done by a supervisor to be provided by the equipment supplier. Estimated time needed is three months.
- Total construction time for the project is calculated to be 12 months including starting period of one month. Interest during construction is based on an interest rate (in US$) of 13 percent per annum.
- Working capital (initial) is calculated on the production of about 300 tons of final products.

ANNEX XIII

JAMAICA

PROCESSING AND MARKETING OF TROPICAL

FRUIT PUREES

ESTIMATED REVENUE

March 1991

Exchange rate used US$ 1.0 = J$ 8.0

ITEM	UNIT	UNIT PRICE	QUANTITY	TOTAL J$ 000
Banana pulp	M. ton	6400	2000	12,800
Mango pulp	M. ton	9600	600	5,760
Papaya pulp	M. ton	4800	400	1,920
TOTAL				20,480

Assumptions:

Banana pulp	US$ 800/ton	CIF	Europe
Mango pulp	US$ 1200/ton	CIF	Europe
Papaya pulp	US$ 600/ton	CIF	Europe

ANNEX XIV

JAMAICA

PROCESSING AND MARKETING OF TROPICAL

FRUIT PUREES

ESTIMATED OPERATING COST

(March 1991)

Exchange rate US$ 1.00 = J$ 8.00

ITEM	UNIT	UNIT COST	QUANTITY	TOTAL J$ 000
Raw material				
Bananas (J$ 0.75/lb)	M. ton	1652	2857	4720
Mango (J$ 0.70/ib)	M. ton	1542	1200	1850
Papaya (J$ 0.75/lb)	M. ton	1652	890	1470
Packing material				
Aseptic bags (200 l/unit)	pc	75	14300	1072
Drums	pc	150	13640	2046
Plastic lining	pc	6	13640	82
Energy				
Fuel oil for steam	ton	2000	20	40
Electricity (35 kwh/h	kwh	1.0	126.000	126
Water	m3	0.1	30.000	3
Labour (32 workers)	man year	1000	32	320
Management (8 persons)	man year	50,000	8	400
Administration				300
Maintenance	%	3	16,000,000	480
Port clearance/domestic transport	M. ton	100	3,000	300
Transport to Europe	M. ton	600	3,000	1800
Cost of working capital	%	10	1,000,000	100
Sales cost	%	5	20,480,000	1024
TOTAL				16,133

ANNEX XV

JAMAICA

PROCESSING AND MARKETING OF TROPICAL FRUIT PUREES

EXPECTED QUALITY STANDARD

Banana Puree

Colour	:	Yellow
Taste	:	Ripe banana
pH	:	4.6 - 4.7 ± 0.1
Structure	:	Creamy, deseeded and defibered
Brix	:	20 - 26 degrees
Celifern bacteria	:	0
Vitamin C	:	min 30 mg/100 gram
Packing	:	Aseptic in plastic/aluminium bags, inside steel drum with extra plastic lining 228 kg net weight ± 2

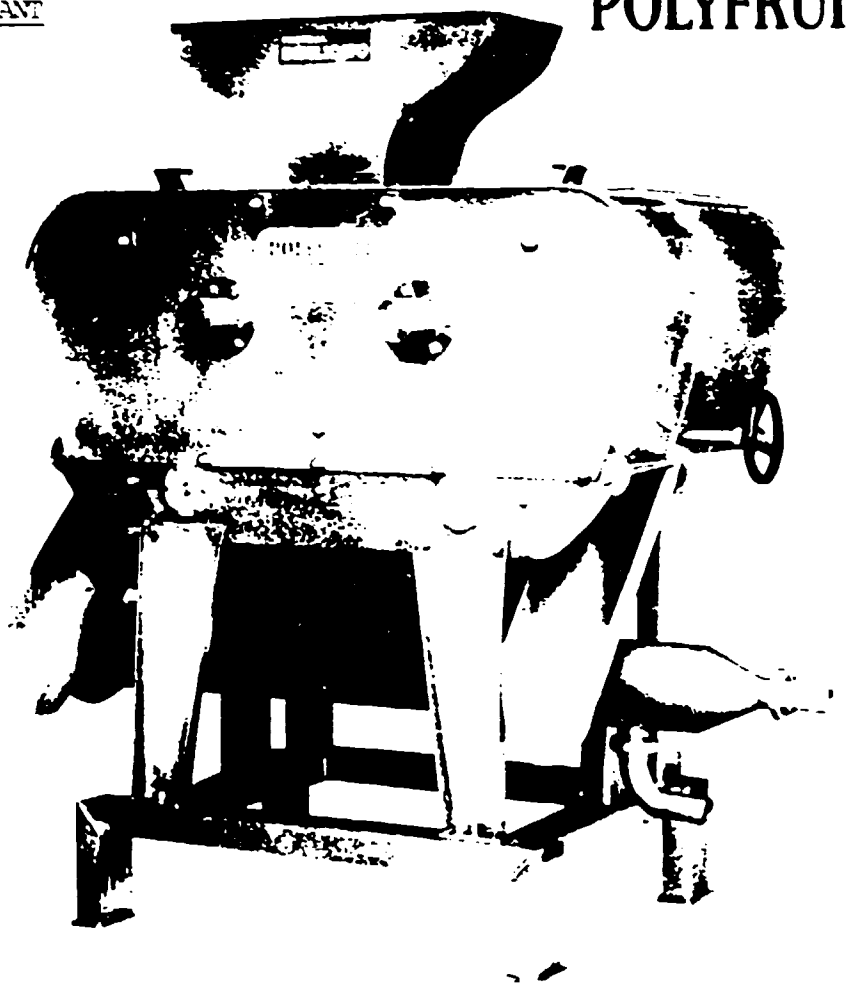
...../2

Mango Pulp

Color	:	Yellow
Taste	:	Typical of ripe mango
pH	:	about 3.5
Structure	:	Smooth, without fibres
Brix	:	About 12 - 14 degrees
Celiferm bacteria	:	0
Vitamin C	:	Min 20 mg/100 gram
Packaging	:	Aseptic in plastic/aluminium bags, inside steel drum with extra plastic lining 216 kg net weight ± 2

DETAILED TECHNICAL SPECIFICATIONS OF KEY COMPONENTS IN THE PROCESSING PLANT

POLYFRUIT



ONE MACHINE FOR THE AUTOMATIC SEPARATION OF THE PEEL AND THE SIMULTANEOUS EXTRACTION OF THE PULP OR THE JUICE DIRECTLY FROM THE WHOLE FRUIT

Our long experience in citrus processing equipment is the basis for the realisation of an universal extractor capable to handle fruits of different varieties and sizes, such as:

— CITRUS FRUITS: orange, lemons, grapefruits, mandarins, limes;

— TROPICAL FRUITS: pineapples, bananas, papayas, melons, guava, kiwi, passion fruits, starfruits, babaco.

The POLYFRUIT machine, type 2001, can be arranged in various configurations, each suitable to process a specific homogeneous group of fruits. The passage from one configuration to another is obtained by replacing some parts: such operation is very simple and can be carried out in about 20 minutes by one person.

The POLYFRUIT is designed to achieve a high operating flexibility: therefore, it is helpful to a wide range of fruit processors.

The great flexibility of this machine has changed the standards of engineering in fruit juice industry.

OPERATION:

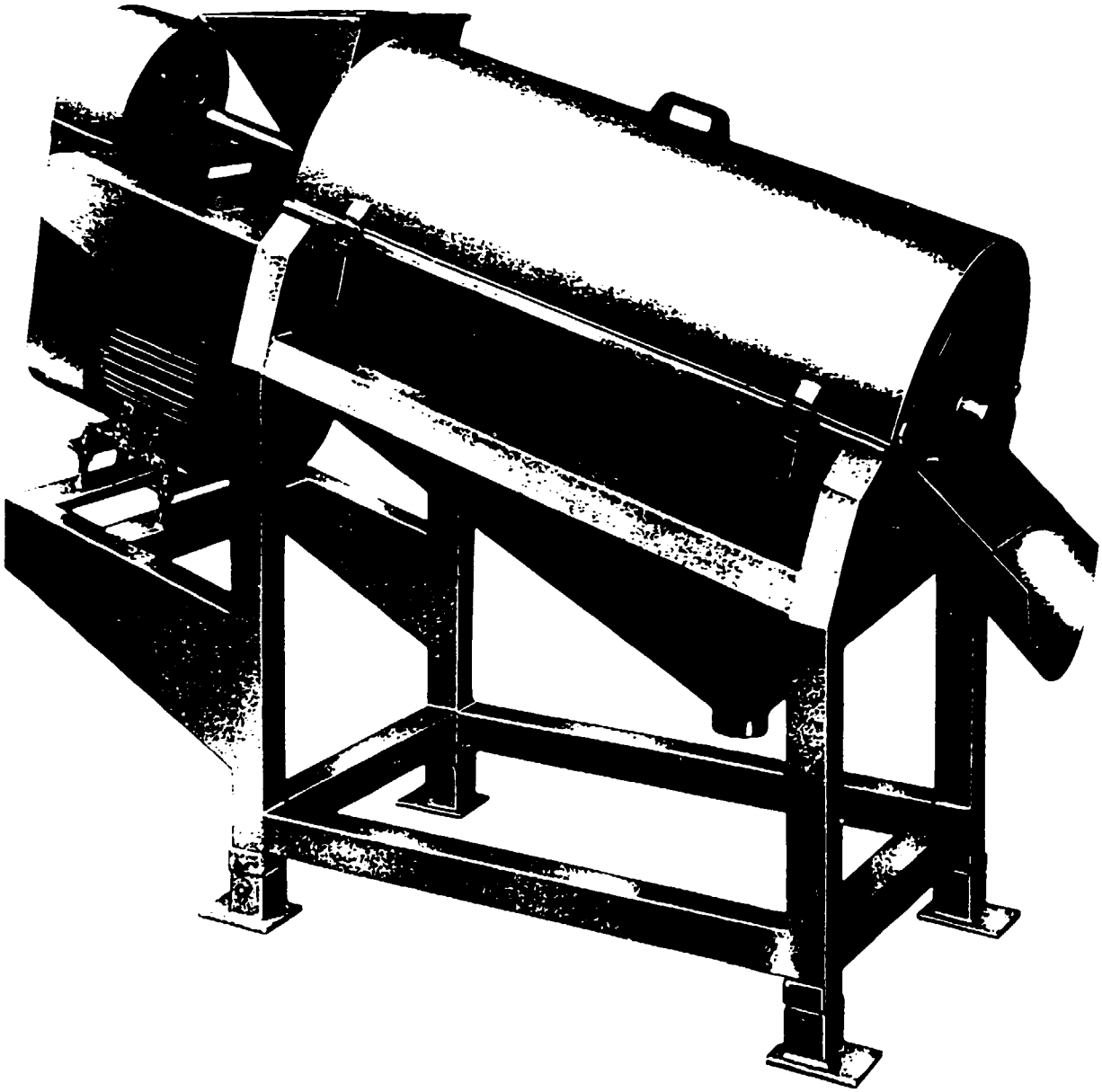
— Fruits of any size enter the machine through the feed hopper at random and without any previous sorting of sizes.
— Two rotating drums intercept the fruits and push them downwards to meet a vertical blade. Here the fruits are cut into two pieces: each half fruit, always in contact with the drum, is dragged along the squeezing channel, where it is progressively pressed against a perforated sheet.
— The juice or the pulp passes through the holes of the perforated sheet and is collected into a tank to be conveyed outwards.
— The peels reach the end of the squeezing channel and are expelled through two inclined chutes.
— The juice is squeezed and conveyed in closed chambers, thus avoiding the contact with air and the oxydation.
— The machine can be completely opened and disassembled in a few minutes for a total sanitary washing.

TECHNICAL DATA:

— Entirely made of AISI 304 stainless steel.
— Driving gear-box with a 5.5 hp electric motor.
— Optional screw conveyor for pulpy juices with a 0.5 hp gearbox.
— Automatic internal washing system with full-cone sprayers.
— Working capacity:
  • citrus fruits: up to 9-10 tons/hour
  • tropical fruits: 2 to 6 tons/hour

OVERALL DIMENSIONS:

— length: 1740 mm.
— width: 1380 mm.
— height: 1710 mm.
— juice outlet: height 550 mm., ∅ 50 DIN.



PULPING-STONING MACHINE

Machine suitable to extract or refine fruit crushes, the stoning process or the taking off the pulp from the stones, according to the outfit of sieves or brushes.

GENERAL CHARACTERISTICS

Stainless steel feed hopper
Stainless steel cylindrical sieve provided with drilling upon request
Stainless steel pin provided with sorghum brushes
Stainless steel pin provided with sorghum brushes
Stainless steel frame with upper hood which can be removed
Stainless steel discharging hopper
[illegible] electric motor with belt drive

OPTIONALS

Motorization with adjustable speed motor 1.5

TECHNICAL CHARACTERISTICS

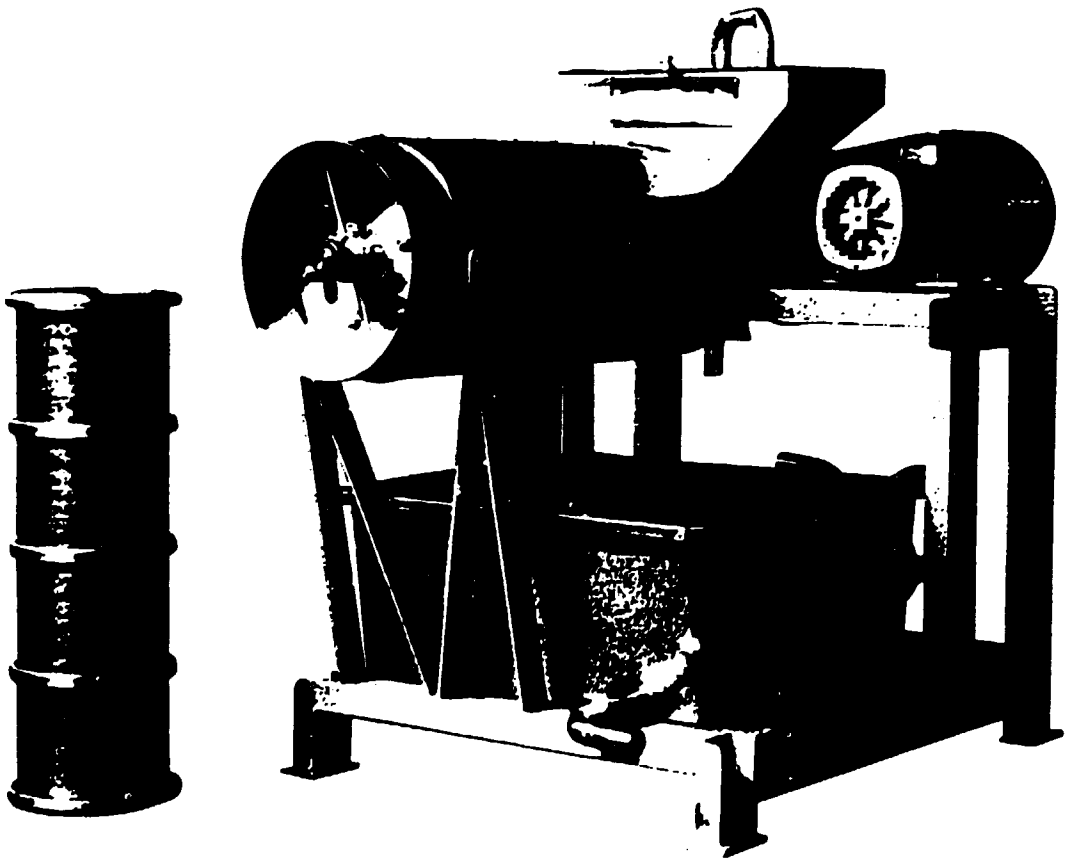
Production: [illegible] kg/hour
Installed horsepower: [illegible]

CONTINUOUS FINISHER

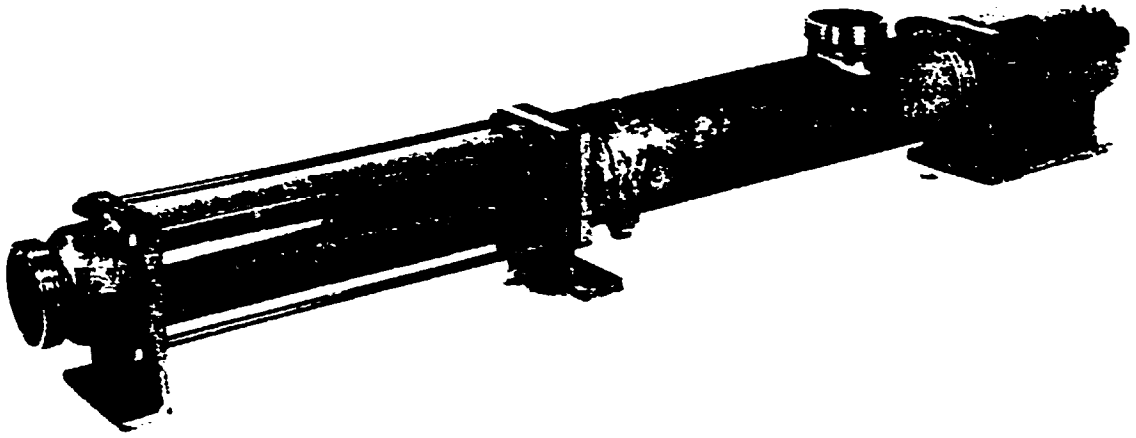
Main technical features:

- Made of AISI 304 stainless steel.
- Frame of mild steel.
- Interchangeable screen with 0.5 - 0.8 - 1.0 - 1.2 - 1.5 - 2.0 mm. holes.
- One 4 kw electric motor.
- Overall dimensions:
  lenght 1555 mm.
  width 920 mm.
  height 1200 mm.

Continuous finisher,
for the reduction of pulp contents



Excenter Screw Pump



Application

Pumping of high or low viscosity liquids (self-priming).

Standard Design

The pump housing and rotating parts are made of stainless steel.

Vulcanized, twist proof stator of synthetic rubber.

Elastic shaft coupling with protecting cover. Bottom plate in welded execution, common for pump and motor.

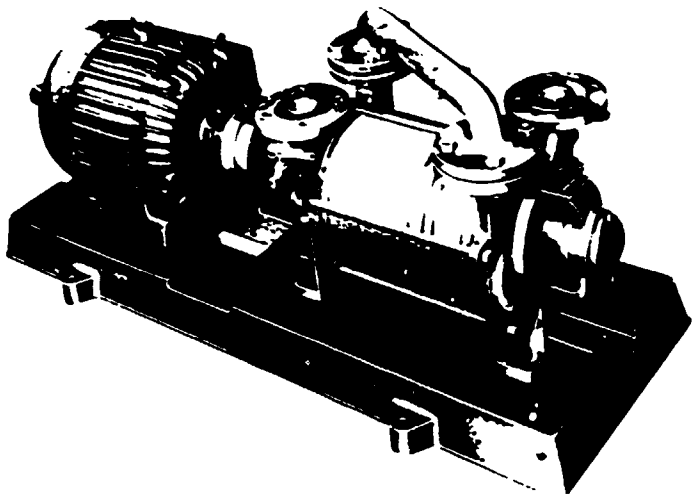
Between pump case and end connection the stator is safely clamped against torsion by main bolts.

The rotation is transmitted by the driving shaft to pin joints, which are clad tight against liquid and the coupling to the rod and the rotor.

Variator for continuously change of capacity.

Sanitary connections, type SMS.

Vacuum pump,



Application

For sucking out uncondensable gases.

Working Principle

A liquid ring rotating, eccentrically to the shaft, within the working chambers of the pump absorbs the drive power delivered to the vane wheel impellers and expends it in gas compression.

Standard Design

The service liquid (normally water) must be admitted continuously to the pump while it is working, so that the heat resulting from gas compression, the greatest part of which is absorbed by the liquid ring, can be lead off. Besides the make-up service liquid supply is to compensate for such quantities as are perpetually discharged with the gas i.e. to maintain the liquid ring.

The liquid can be separated again from the gas in a circulating container.

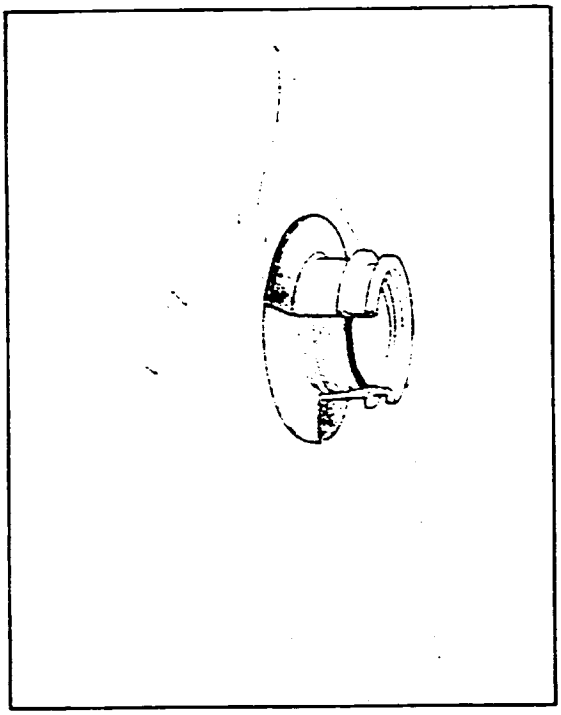
The pump is of the valveless rotary-displacement type. The only parts to move are the shaft and the vane wheel impellers. These are not subjected to friction on stationary pump components. The shaft is on both ends supported by antifriction type bearings.

Shaft sealing is effected by stuffing boxes.

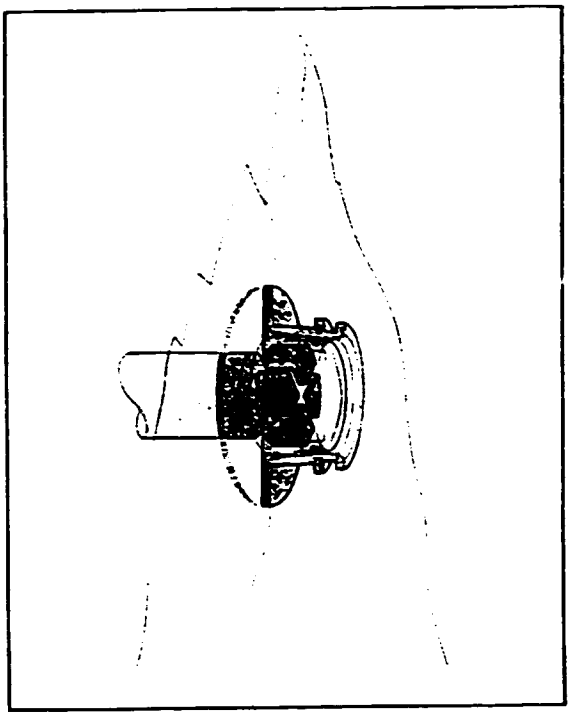
A complete system for supreme product quality

Asept offers a high filling capacity of up to 10,000 litres per hour in a twin-head unit. Although it is intended primarily for large packages of 100–1,000 litres, it can also be used for sizes outside this range. The filler is built of standard modules and can easily be modified to meet specific customer requirements.

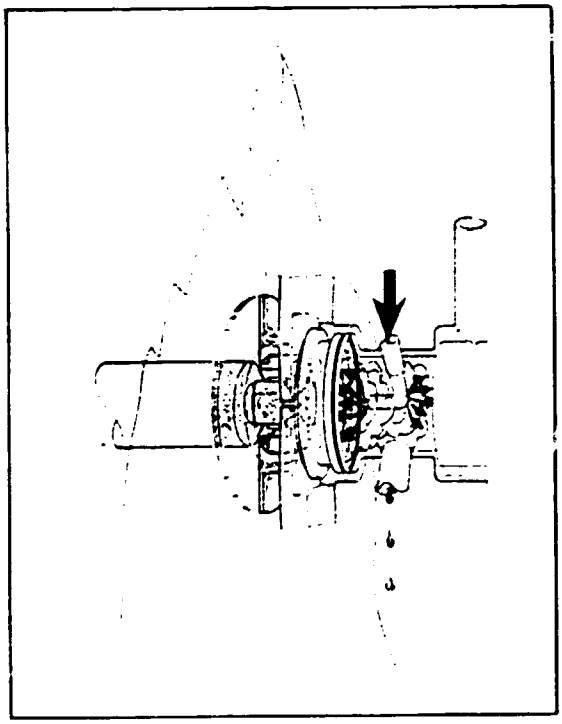
Unique spout design



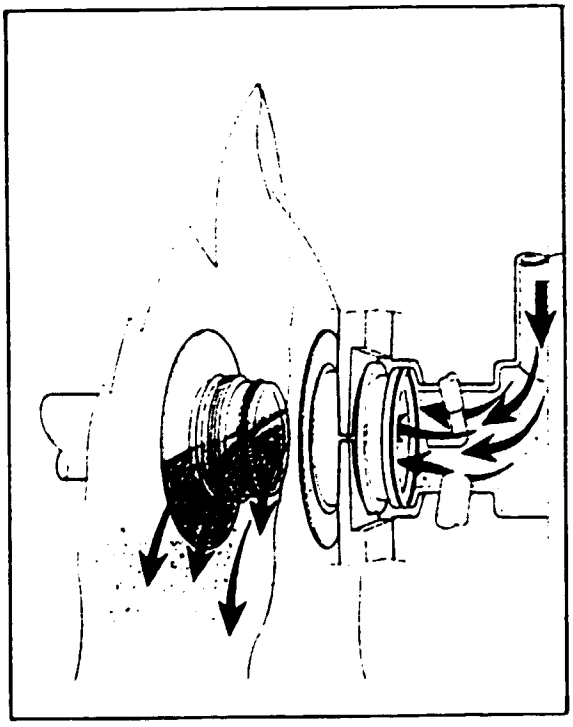
The patented spout combines simplicity and safety, which substantially reduces the risk of oxygen contamination.



The gripper is ready to engage the bung



The spout with its exposed bung face is sterilized by steam at a pre-set time and temperature



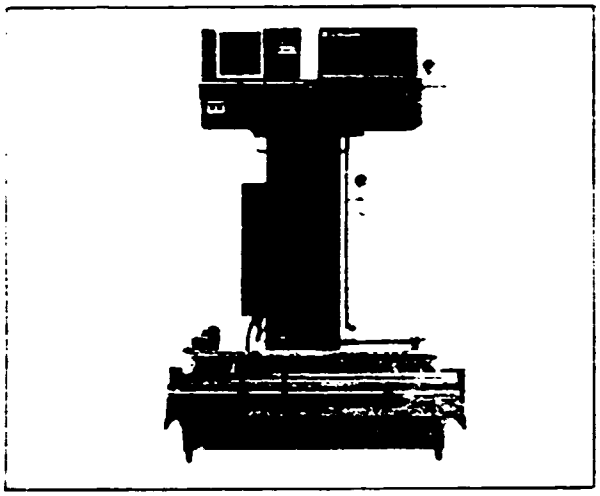
After sterilization, the filling valve opens and the spout bung is withdrawn. The package is ready for filling

The most profitable system on the market

The Aseptic system features a unique spout design. The system has been optimized from filler to final package in order to maximize product quality throughout the distribution chain. Main features include:

Spout design minimizes oxygen penetration.
Steam sterilization of the spout. No chemicals to contaminate product.
No sterile chamber. Design is simplified, less steam is consumed.

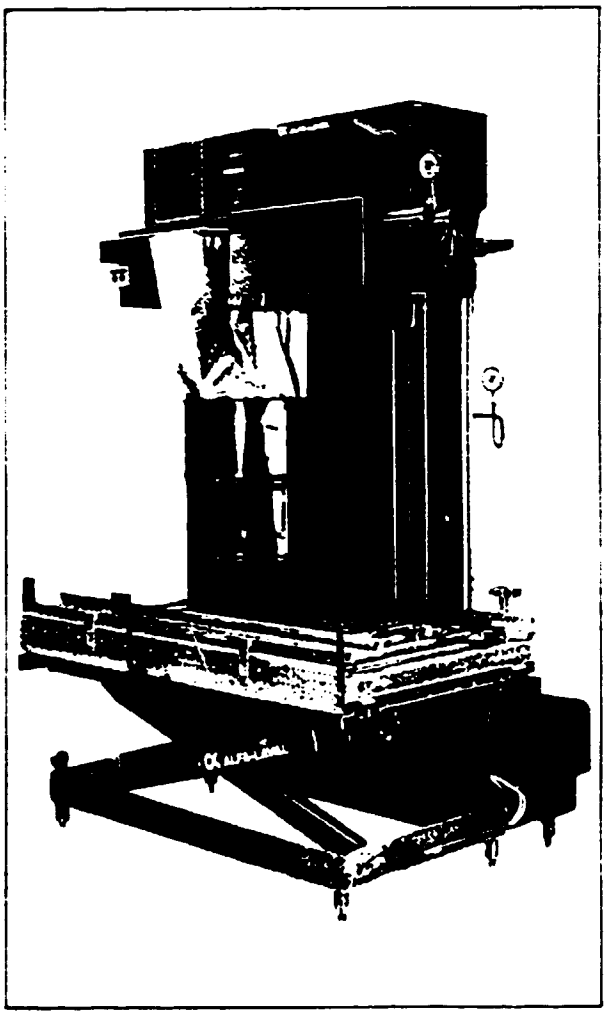
The same system can be used for high- or low-acid products, even in particle form.
Spout enables aseptic emptying.
Load-cells ensure high filling accuracy.
No headspace when filling is completed, which minimizes the amount of air in the package and reduces flex-cracking.
Special laminated material with maximum resistance to flex-cracking.



The filler is a self-contained unit. It is delivered ready for connection to a power supply, pneumatic hoses and a product supply line.

The pump is engaged by a gripper, and the package is held in place by bars.

For safety's sake, two buttons must be pressed to start the system. The [illegible] is then moved by the [illegible]



The package is pre-filled with 10–15 % of the total product quantity. When the programmed pre-filling is completed, the lifting table rises to the intermediate level, where filling continues.

A new approach to aseptic bulk packaging

Systems for aseptic packaging, storage and distribution of food products in large containers are rapidly replacing conventional techniques. The new technology offers several advantages:

- Higher, more consistent product quality
- More economical distribution and handling
- Reduced costs of labour, packaging and storage
- Less seasonal dependence, improved plant utilization

The unique Asept system represents an entirely new approach to aseptic bulk packaging and distribution.

The Asept system is simple and highly efficient. It can be used for a wide range of both high-acid and low-acid liquid products, including high-viscosity or particulate products.

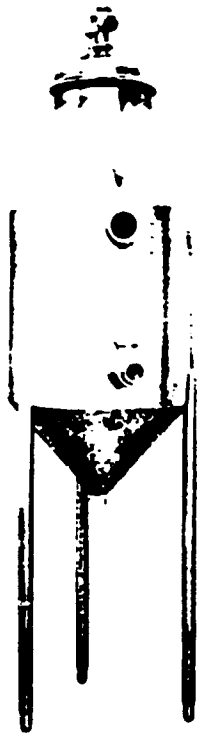
High-acid foods

Dressing
Fruit concentrate
Fruit squash
Guava
Jam
Juice
Ketchup
Mango
Pineapple
Purée
Syrup
Tomato products
Yogfruit

Low-acid foods

Coconut cream/milk
Cream
Edible oil
Ice-cream mix
Milk
Milk-shake
Sauce
Soup
Soy milk
Yoghurt

Vacuum chamber



Application

Vacuum deaeration of cold or preheated liquids, particularly viscose products such as juice concentrate, nectars, purees, etc in order to avoid loss of vitamin content and deterioration in quality.

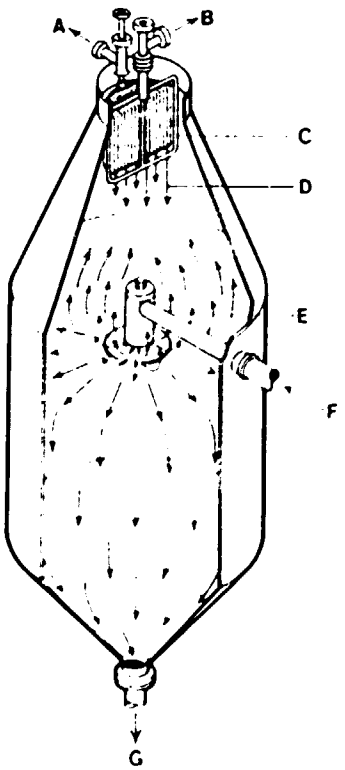
Working principle

The product is pumped to a centre type spreader and sprayed into the vacuum chamber. The flow is automatically controlled by means of a float operated level control which maintains a constant level of the product in the chamber.

When using positive pumps the flow can be controlled by using variidrive on the pumps.

The vacuum in the chamber, which is maintained by a water ring vacuum pump, is controlled by a pressure control (PC) and indicated on a vacuum gauge (PI). The air removed from the product is drawn off by the vacuum pump.

The deaerated product is discharged from the chamber by a pump and fed to subsequent processing, usually pasteurization. The chamber type DD can have either an external condenser or to be equipped with a top-mounted, water-cooled condenser, where the vaporized water and volatile constituents from the deareated product are condensed. The condensate flows back to the product, and only non-condensable gases – mainly air – are removed from the product.



Basic unit

Versions. Three sizes: DD 500, DD 750 and DD 1000. Chamber is marked with additional figures indicating:

E = Without level control
L = With level control
C = With top-mounted condenser
EC or LC = Combination according to above mentioned equipment

DD 750-C and DD 1000-C are supplied with either 3 m^2 or 5 m^2 condenser.

Standard design. Tank, cover and fittings of acidproof stainless steel, mat blasted finish. Double-walled conical bottom for foamdamping and cooling by means of water. Two removable sight glasses. Three stainless steel legs with adjustable feet

Vacuum chamber principle

A – Gases out
B – Cooling water out
C – Condenser
D – Condensed vapour
E – Vapour and gases
F – Product in
G – Product out

Vacuum chamber

Technical data

Flow rate.

DD 500 max 5.000 l/h
DD 750 max 10.000 l/h
DD 1000 max 20.000 l/h
Max. flow rate depends on viscosity of product

Condensor capacity.

300 resp. 550 kg/h vapour with a temperature higher than 60°C can be condensed in the topmounted condenser size 3 m² and 6 m² respectively by using cooling water of 20°C.

Cooling jacket capacity. 300 – 500 l/h.

Tank volume.

DD 500	200 l
DD 750	500 l
DD 1000	1090 l

Shipping data

	net weight (kg)	*gross weight (kg)*	*volume (m^3)*
DD 500	80– 90	180–200	0.7–1.1
DD 750	155–175	280–320	1.8–2.3
DD 1000	240–260	450–490	3.1–3.9

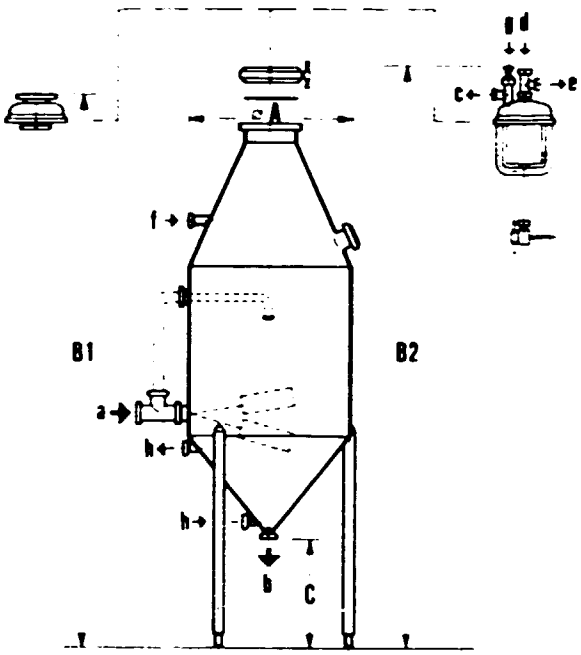
Optional extras

Vacuum controller
Vacuum gauge
Vacuum pump
Extended legs

Dimensions (mm)

	A	*B1*	*B2*	*C*
DD 500	505	1875	2050	350
DD 750	760	2300	2500 (2900)	500
DD 1000	1010	2850	3050 (3450)	500

(Heights in brackets are for 6 m² condenser)



Connections

a) Product in – 51 mm
b) Product out – 76 mm or 102 mm (DD 1000)
c) Gases out – 51 mm
d) Cooling water in 51 mm
e) Cooling water out – 51 mm
g) Cleaning liquid to spray nozzle – 25 mm
h) Cooling water to and from bottom – R 1"

Aseptic bulk filling machine

Application

Filling of bulk-size packages with liquids of high as well as low acidity, under aseptic conditions. High-acid liquids may even contain solid or semi-solid particles. The filler is designed for CIP.

Working Principle

Package. The packages are manufactured from a variety of laminates to match the product and required shelf-life. The packages are provided with patented spouts designed for aseptic filling. The inside of the packages is sterilized before delivery; the packages are supplied flat and contain no air or gas. They are available in volumes from catering size up to sizes intended for shipping of product from manufacturer/grower to processor/packer/distributor. All packages are intended to be supported, when filled, by an outer container, for instance a barrel or heavy-duty cardboard box.

Filler. The main sections are
Roller conveyor on hydraulic lifting table
Filling head with package manipulation and filling devices
Control and operator panels
Service units including electrical gear, steam and pneumatic valves, lifting table hydraulics, etc
Machine frame

The filler is normally installed together with barrel (or box) feed and discharge conveyors. In front of the filler, an operator's bridge should be placed (bridge and ancillary conveyors are not included in the standard aseptic bulk packaging system equipment)

Filling cycle. The filling cycle is divided into a manual preparatory part and an automatic filling part

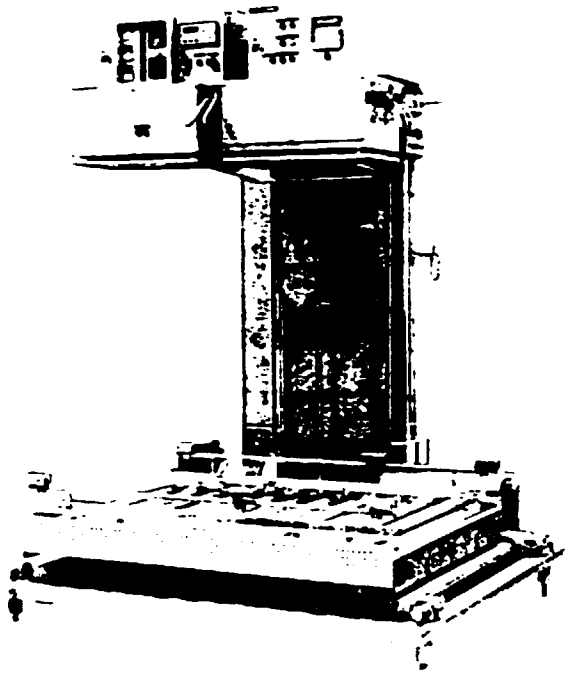
Manual preparation

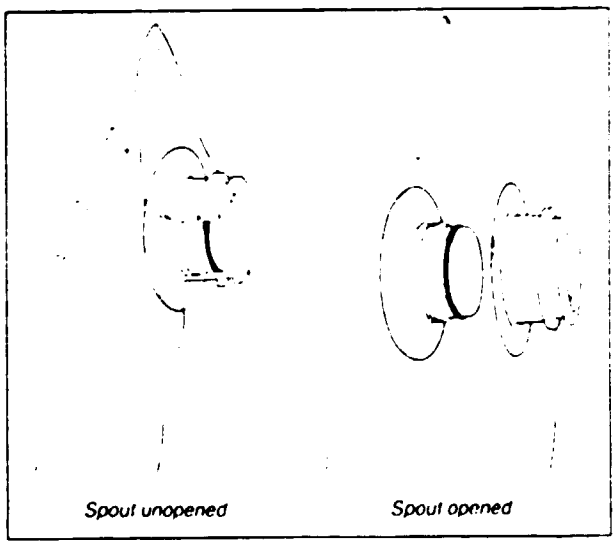
1 The operator takes a flat and sterile package from its wrapping and places it inside a barrel arriving on the feed conveyor (most common production set-up for large packages). The operator pushes a button to start the conveyors and initiate the filling cycle. A barrel moves into position underneath the filling head. The lifting table ascends to prefilling level, and the spout bung gripper moves to engage the bung.

2 The package now in filling position, the operator pushes a pair (for safety) of buttons. The still unopened spout is brought to the filling valve.

Automatic filling

3 The spout is pressed tightly against the filling valve outlet.
4 Steam is admitted to the filling valve chamber, sterilizing it and the spout including its exposed bung face. Air and condensate are expelled.
5 Sterilization takes place at setpoint temperature and time, monitored by the fail-safe control system of the filler.
6 After sterilization, the filling valve opens and simultaneously the spout bung is withdrawn. Product enters the package.
7 Prefilling, main filling, and topping-up take place at different lifting table levels until the load cells sense the preset weight.





Spout unopened *Spout opened*

8 The filling valve closes, and steam enters the filling valve chamber, forcing remaining product into the package. Steam then enters and inflates the top of the package.
9 The inflated package triggers a sensor, causing the spout to be closed while still in a sterile environment.
10 With no air or gas headspace, the completely filled package is released and descends on the lifting table to be taken away by the discharge conveyor.

Aseptic bulk filling machine

Operation. The lifting table is hydraulic, and the package manipulation devices are operated by pneumatic cylinders. The steam and filling valves are pneumatic and solenoid operated

Control system. The control system features an Alert 05 microcomputer process control unit. The package positions on the conveyors are marshalled by photocells and the lifting table levels by proximity switches. Prefilling is time-controlled, and main filling and topping-up are weight-controlled by means of load cells. Sterilization is safe-guarded by a timer and temperature monitor, and both are recorded on a chart. Should the temperature drop below setpoint, the sterilization procedure is automatically restarted from the beginning

Sampling. Facilities are provided to draw small samples of product in the course of production.

Cleaning. The filler is designed for CIP. During cleaning, a dummy spout is placed in the filling valve outlet. Cleaning in line with the sterilizer. Recommended flow rate 12 000 l/h.

Capacity. The capacity depends on package volume, product characteristics, product supply facilities and pressure, and operator dexterity. A twin filler installation more than doubles the capacity and improves utilization of the operator's time by allowing him to prepare and sterilize one package while the other one is being filled; initial and concluding filling (when flow rate is reduced) of the two packages can also overlap.

Basic unit

Standard equipment. The filler is a self-contained unit, ready to be sited and connected to electric, pneumatic, and steam services and the product supply line, and the feed and discharge conveyors. The latter are not included; nor is the operator's bridge.

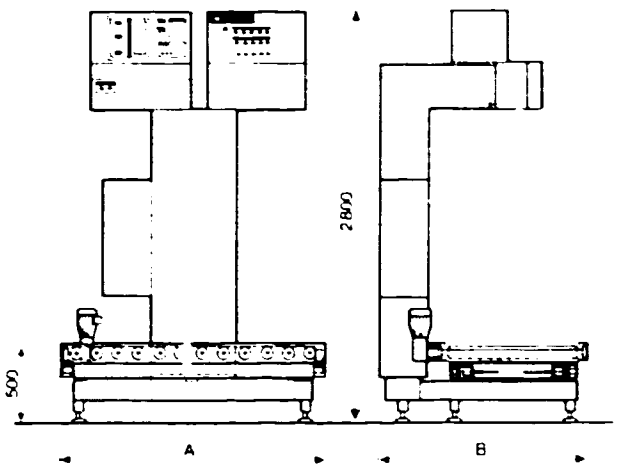
Material. All parts in contact with product as well as the upper framework, panels, and spout mechanism are of stainless steel. The lower framework, lifting table, and roller conveyor are of galvanized mild steel.

Versions. Single filler with 920 mm or 1300 mm wide lifting table and roller conveyor. Twin filler consisting of two identical single fillers

Optional Equipment

- Voltage stabilizer
- Filter for culinary steam:
  Alt. 1 Steam separator, steam trap
  Alt. 2 Steam separator, steam filter, steam trap
- Lower framework, lifting table, and roller conveyor made of stainless steel instead of mild steel
- Band conveyor for handling smaller bags into cartons
- Operator's bridge

Dimensions



Conveyor width, mm	A mm	B mm
920	2180	1760
1300	2180	2090

Technical Data

Steam supply. 400 kPa (4 bar); culinary quality steam recommended, max. 20 kg/h

Compressed air. 600 kPa (6 bar), 20 Nl per package

Electric power. 220/380 V 50 Hz 3-phase or 220V 50 Hz 1-phase AC (other voltages on request), 5 kW

Product supply. 50–200 kPa (0.5–2.0 bar) depending on product viscosity

Connections. Inlet and outlet 51 mm (2 in). SMS union

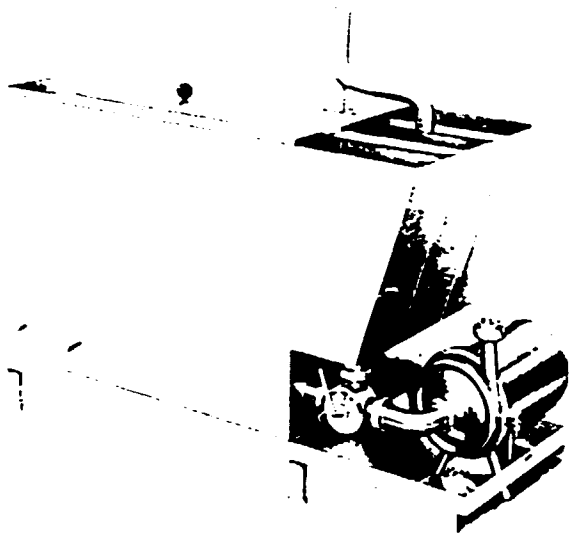
Shipping Data

	920 mm conveyor	*1300 mm conveyor*
Net weight	1500 kg	1730 kg
Gross weight	2200 kg	2450 kg
Volume	15.3 m^3	17.8 m^3

Cleaning Unit

Application

Cleaning of pipe-lines, tanks, plate heat exchangers, etc through circulation of cleaning liquids



Working Principle

The unit consists of a detergent tank (A) with three funnels (B), (C), and (D). There is also a centrifugal pump (E), a 3-way cock (F), and a swivel pipe (G) on the return line, discharging into any one of the three funnels.

After connecting the object to be cleaned to the cleaning unit, the object is rinsed by means of cold water from a water inlet (H) via the water funnel (D), 3-way cock (F), pump (E), and return line swivel pipe (G) directed into the drain funnel (C).

Thereafter, the cock and swivel pipe are changed over, and detergent is circulated through the object for the required length of time, after which the detergent is returned to the tank via the detergent funnel (B) for reuse.

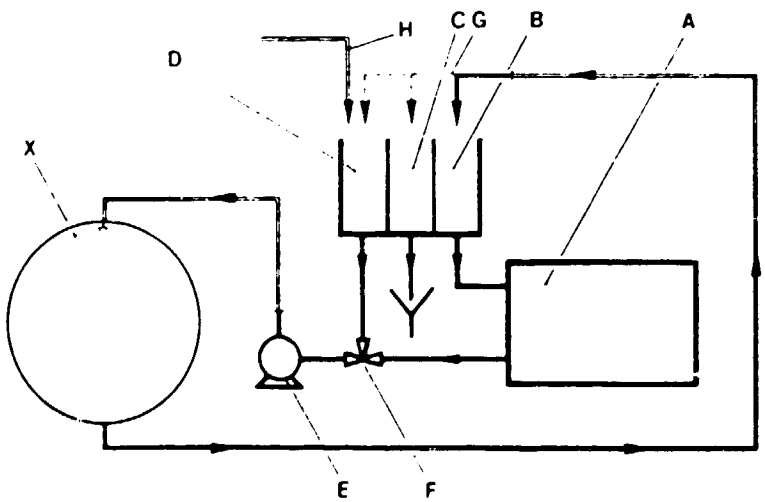
By means of a steam injector or plate heat exchanger (both optional equipment, see below), the cleaning liquids may be heated. For instance, hot water may be circulated through the cleaning object to disinfect it. This is done in the same way as in cold water rinsing except that the return line swivel pipe is directed to discharge the hot water into the water funnel (D) for recirculation.

Other swivel pipe/3-way cock settings allow other flow paths, for instance to dispose of spent detergent, or if special cleaning programmes are to be applied.

Basic Unit

Standard Equipment. Self-contained unit including detergent tank, funnels, swivel pipe, pump with motor, 3-way cock, and in-unit pipe work, all mounted on frame with adjustable ball feet.

Material. Stainless steel.



A Detergent tank
B Detergent funnel
C Drain funnel
D Water funnel
E Centrifugal pump
F 3-way cock
G Swivel pipe
H Water inlet
X Cleaning object

Cleaning Unit

Technical Data

Tank Volume. 400 l

Flow Rate. 6 000–12 000 l/h

Pump. Centrifugal pump, type FM-1A 220/380 V 50 Hz 3-phase AC 3.0 kW (other voltages on request)

Connections. Inlet and outlet 51 mm (2") SMS dairy pipe union

Optional Equipment

1. Steam injection and temperature regulation set, for direct steam injection into detergent tank.
2. Dial thermometer with stainless steel bulb, 0 – 120°C.
3. Plate heat exchanger, type P2-VXL (wall-mounted, mild steel). For heating cleaning liquids; heating to cleaning/disinfection temperature (70/95°C) by means of steam during circulation. Flow rate 12.000 l/h. Complete with protecting sheet and thermometer.

3.2 Ditto, type P2-HBM (floor-mounted, mild steel).

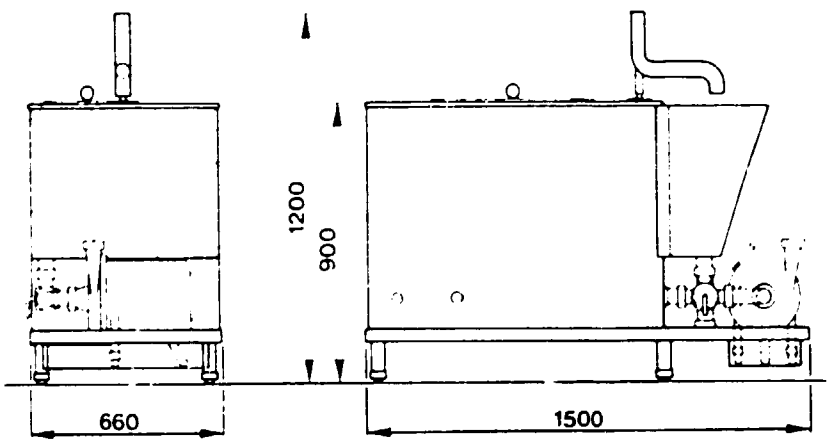
3.3 Ditto, type P2–HRBL (floor-mounted, stainless steel).

Note: Items 1 and 2 cannot be used if item 3 is selected and vice versa.

Shipping Data

Net weight	150 kg
Gross weight	280 kg
Volume	1.9 m^3

Dimensions (mm)



ANNEX XVII

THE JAMAICA BANANA INDUSTRY AND DEVELOPMENTS IN ITS EXPORT MARKETS

THE JAMAICA BANANA INDUSTRY AND DEVELOPMENTS IN ITS EXPORT MARKETS

The Jamaica Banana Industry, the island's second most important agricultural enterprise, began about one hundred and twenty years ago and is still of considerable importance to the Jamaican economy. It provides employment for a wide variety of workers ranging from the numerous small farmers who grow the fruit, the workers on the farms, the dock workers who load the boats to the administrative workers responsible for organising the purchase, transport and marketing of the fruit.

Introduction of the Banana Plantation to Jamaica

The banana plant was introduced into Jamaica around 1541 and cultivation of the fruit was done on a small scale for domestic consumption. The "Gros Michel" variety was introduced into Jamaica around 1935 from Martinique, and this variety formed the basis of the export trade. The "Chinese Banana", a dwarf variety, was imported and planted first at Bath in St. Thomas in 1894, while the "Robusta" variety was brought in from Guatemala in 1909. The "Lacatan" variety was first introduced from Trinidad in 1926, and 1963 saw the introduction into the island of the "Valery" variety. Between 1982 and 1983, the "Grande Nein" — propagated from tissue culture, and the "Williams" varieties, were commercially introduced into Jamaica.

Currently, the "Grande Nein" and "Williams" varieties form the bulk of Jamaica's export fruit. The "Valery" and "Robusta" are also still exported but to a lesser extent, while pockets of "Gros Michel" are still to be found. In all, there are more than 23 varieties of banana plants to be found throughout the island.

The beginning of the Banana Export Trade

In the early 19th century, sailors oftentimes took on board their ships a few bananas for consumption purposes. However, it was Captain George Busch, the seller of Cuban fruits including bananas on the U.S. market, who initiated the Jamaican trade. In 1866 when he was unable to obtain fruits from Cuba turned to the north coast of Jamaica for supplies. The huge profits made from this first shipment influenced his return. Foreseeing the prospects of a highly profitable

trade, he encouraged planters to increase their production and this was met with favourable response.

In 1870, Lorenzo Baker, a fruit trader with Central America and the U.S., on hearing of the good quality of the Jamaican bananas; obtained a return cargo to New York on one of his trips from Central America. Profits from this trip were enormous, so on his return to Jamaica he brought a cargo of flour, pork, salted cod fish, shoes, cotton prints and other merchandise. These he sold at a profit and returned to New York with his schooner filled with bananas and coconuts, thus beginning a two-way trade with the U.S.A. and Jamaica.

Baker and Busch together encouraged farmers to increase their cultivation of bananas, while they established trading and shipping companies to enhance trade transactions. As trading became successful, it was decided to invest some of the profits in purchasing properties. Bog Estate near Port Antonio and Bowden Estate in Port Morant, where a deep water pier was built, were the first two properties purchased. By 1885 the company had acquired 13,000 acres in Jamaica.

The growth in demand for bananas in the U.S.A. was tremendous and in order to maintain constant supplies, despite drought and hurricanes, 40,000 acres of bananas were established in the Dominican Republic as a back-up supplier. In 1899, the United Fruit Company took over the fruit trade between the U.S.A. and Jamaica.

Between 1870 and 1932, the Jamaican trade was mainly with the U.S.A. although a small amount of fruit had been finding its way gradually on the British market. The first shipment of bananas from Jamaica to Britain was made in March 1895. Sales were extremely profitable and shipments were made thereafter at irregular intervals The British firm Elders & Fyffes soon controlled the trade, utilizing ships specially fitted with refrigerating apparatus. By 1901, however, the United Fruit Company acquired the controlling interest in Elders & Fyffes Limited, thereby controlling the trade. A fortnightly service was inaugurated and approximately 50,000 stems were exported monthly.

In 1932, a radical change occurred with the signing of the Ottawa Agreement and the adoption of the Empire Preference Rates of Duty. Jamaican producers found themselves at a decided advantage in the English market with such tariff protection. More attention was then given to the English market and the American trade declined as the English trade grew.

Jamaica was a stronghold of the United Fruit Company until the second world war, although several other companies operated here. By 1939, it owned large properties in the island and maintained a virtual monopoly of the shipping of the Jamaican fruit. Bananas produced by individual growers were contracted to the shipping company with reasonable assurance of sale at the then current market price. Individual producers could only sell their fruits when space was available and when the retail market could accept it. So to a number of planters and most small farmers there was no assured market.

Between 1903 and 1930 a series of attempts were made to establish an independent shipping agency to Jamaica and by 1930 the Standard Fruit & Steamship Company was established. Concurrently, islandwide co-operatives came together to form The Jamaica Banana Producers Association, (JBPA) which absorbed the banana business of Jamaica, establishing its own marketing organisation in the United Kingdom and its own lines of banana-carrying ships to operate between Jamaica and the United Kingdom. The Association also provided the stimulus of competition with the United Fruit Company and the price of bananas to the Jamaican growers rose to the highest in the world.

This competition led to the defection of grower support from the Jamaica Banana Producers Association to the United Fruit Company who offered more attractive prices, and resulted in bankruptcy of the Association. On the rebound, the Association ceased being a co-operative and became a company with shareholders being able to enter contractual arrangements which were in the interest of the growers, and with its main aim being that of providing a secure market for Jamaica bananas and stability for the growers.

The United Fruit Company then became an alternate means of selling bananas. During World War II when no fruit could be shipped from the island, the U.K. Government subsidised the Jamaican Banana Industry and after the war, up until 1951, the U.K. Ministry of Food bought all the Jamaican crop under bulk purchasing arrangements.

Up to the 1970's, the "Lacatan" variety formed the bulk of banana exports, as production of the "Gros Michel", which is highly susceptible to Panama disease and for which no economic cure had been discovered, was gradually phased out. The expansion of "Lacatan" began in 1947 and by 1953 exports surpassed those of "Gros Michel". The "Valery" variety joined the "Lacatan" and "Robusta" in forming most of Jamaica's exports up until the 1980's when the "Grande Nein" and "Williams' varieties were introduced and

these have now taken over the export market to the extent of forming 80 percent of export fruit.

The Industry since 1970

The post-war Jamaican industry is fundamentally different from that of the pre-war. With the exception of occasional small quantities which have been sent elsewhere, Jamaica's banana exports went to the U.K.

The comprehensive organization of the banana industry which has grown up in Jamaica since the war came about as a result of certain basic needs. For example, soils in many areas were near exhaustion, Panama disease was steadily wiping out the principal variety and with the introduction of the "Lacatan" variety, leaf spot control on a large organised scale became necessary. Although the "Lacatan" variety is resistant to Panama disease, it is itself highly susceptible to leaf spot which can be controlled by spraying.

The Banana Board, which was the purchasing agency and the only organisation permitted to export fruit from the Island, organized the control of leaf spot under contract with a private spraying company. An intensive programme in soil conservation, use of fertilizers and disease control was implemented and small farmers were encouraged to continue to grow bananas in view of the ready economic gain available to them.

During the 1960's and 1970's exports fluctuated because of varied reasons, for example, adverse weather conditions, (drought, floods and hurricanes) and their attendant devastating effects affected production and because of inadequate financing, most farmers were unable to resuscitate their fields in sufficient time to maintain production. In addition, demand on the domestic market continued to increase resulting in a decrease in the amount of fruit available for export.

However, prices in the U.K. market were on the increase. Although prices to growers increased steadily, they were marginal.

The following table show banana exports to the U.K. with average U.K. prices per ton as well as growers' average prices per lb. between 1963 and 1989:

BANANA EXPORTS — 1963-1989

YEAR	EXPORTS TONS	AVGE. PRICE J$ PER TONNE	GROWER AVGE. PRICES (LB) STEMS	EXPORT VALUES US $MN
1963	159,917	124.8	1.2¢	14.8
1964	174,383	130.3	1.24¢	8.5
1965	199,629	114.9	1.090¢	8.5
1966	200,274	109.7	1.096¢	12.6
1967	197,473	115.1	1.04¢	13.3
1968	163,356	161.8	1.178¢	13.8
1969	150,937	155.8	1.275¢	12.5
1970	134,255	162.7	1.606¢	11.8
1971	125,849	173.5	1.66¢	11.7
1972	127,045	176.8	1.66¢	11.8
1973	107,706	246.6	1.81¢	16.4
1974	71,343	293.7	2.78¢	11.5
1975	70,206	359.1	5.9¢	14.7
1976	79,248	294.5	6.00¢	11.9
1977	80,098	445.1	6.00¢	13.5
1978	77,855	707.5	6.60¢	17.4
1979	68,834	825.4	9.00¢	18.2
1980	33,107	925	11.99¢	10.5
1981	18,744	1025	14.5¢	4.3
1982	21,878	1086	17.5¢	4.7
1983	23,456	1228	23.4¢	6.8
1984	11,058	2299	42¢	1.5
1985	12,742	3232	44¢	4.1
1986	20,713	4259	94¢	9.2
1987	34,231	5130	$1.31¢	19.1
1988	28,058	5230	$1.25¢	15.7
1989	42,607	5270	$1.25¢	19.3

Source Annual Reports of AIBGA 1973-1980
Economic & Social Survey 1967-88 (PIOJ)

In 1973 there was a significant decrease in banana exports which brought Government's focus on the industry and the All Island Banana Growers Association came under the auspices of the Banana Board which was to administer a J$10mn. Banana Industry Development Programme.

This programme encompassed the following:

a) **A replanting and new planting scheme aimed at putting into production an additional 30,000 acres of new plants. This was**

to bring about significant increases to the volume of export bananas as well as ensuring greater financial results to growers through higher yields and better quality products.

(b) A loan scheme to cover acquisition of agricultural implements and farm vehicles to undertake land preparation and the construction of farm buildings and roads.

(c) There was also a material credit scheme, and a fertilizer, pest and disease control facility which were made available to growers.

(d) An increase in the price of fruit to growers from 1.60c to 2c and a bonus were also introduced as incentives to farmers for improvements in the quality of the fruit produced.

(e) Reorganization of research activities was initiated and extension services formally administered by the All Island Banana Growers Association came under the Banana Board and the Ministry of Agriculture for effective policy direction and administration. Agricultural training programmes were also revived and the establishment and growth of co-operatives were emphasised as the instruments for the economic and social development of the small farmers. Co-operatives were also to provide the opportunities for the encouragement of initiative, development of thrift and the sound use of credit, savings and other resources.

(f) Duty free trucks were also imported to assist with the transportation needs of the industry.

There was a positive response from growers to this programme. In 1975, prices to growers were also increased by 100 percent from 3c to 6c. However, production fell as a result of severe drought conditions. Jamaica's share in the U.K. market also fell due to declining exports and poor quality fruit. Greater attention was therefore given to the marketing of the fruit and towards this end a number of recommendations were made. These included:

(1) Proper fruit protection such as bunch-sleeving, pest control, field sanitation, leaf pruning and debudding as well as reaping and packaging techniques and material; and

(2) Seminars were to be set up to give practical demonstrations of methods of handling at various stages to ensure quality product to the consumer.

The implementation of these brought positive results but the industry was confronted with other challenges. Another re-organisation programme was proposed but for this to be effected there had to be serious disruptions in the industry. However, the devastation of the industry in August 1980 by hurricane "Allen" provided the opportunity to take the necessary actions to stimulate and improve production and efficiency. A J$40mn. reconstruction programme was subsequently put in place.

The current status of the industry

As a result of that restructuring programme, and in conjunction with loans and grants from international organisations as well as joint venture capital injected into estate development, the industry is currently poised for growth.

Between 1987 and 1989, over J$300mn. has been expended on the banana industry with the objective of increasing exports to 150,000 tons per annum. In 1985, a private company — the Banana Export Company (BECO) — was formed and given the responsibility of marketing the fruit.

Three major banana estates have been established in St. Thomas, St Mary and Clarendon — all joint venture projects with the Government, local and international financial and technological inputs. The thrust has been on large-scale production. These projects encompassed 4,500 acres which are projected to produce 90,000 tonnes by 1992 yielding 20 tonnes of fruit per acre. These large estates utilize modern planting, harvesting, processing and packaging techniques, and presently account for 80 percent of banana exports. Traditional growers supply the remaining 20 percent.

Nonetheless, considerable attention is still focussed on the small and medium size farmers in the industry with a view to improving and upgrading their production. While growers are mostly located in the traditional banana parishes of St. Mary, Portland, St. Thomas and Clarendon, cultivation is to be extended to the western parishes of the island and young people are being encouraged to participate in the industry.

There are 36 boxing plants islandwide, a few co-operatively operated in the banana producing areas as well as those on the larger estates. In order to maintain good quality exports, only bananas rating 70% and above are selected for exports. The Banana Export Company has introduced full palletization of the banana cargo, thereby ensuring the maintenance of good quality fruits arriving in the U.K. A weekly shipment service is also utilized.

Problems of the industry

The Jamaica Banana Industry over the years has never been without its peculiar problems and while efforts have been made at re-energising and restructuring it for growth and development, the problems have never been eradicated.

The climatic factors of droughts, gale-force winds, floods and hurricanes are those over which there can be very little control. An adequate water supply to irrigate accessible banana fields in times of drought could be a reality, but there is no control over winds, rains and floods to which the island is prone. These climatic factors usually effect the most devastating blow to agricultural crops and bananas especially since the plants are fragile and lend themselves to easy destruction by winds and floods. The rehabilitative process after such destruction is usually expensive and lengthy.

Even with the introduction of new varieties of bananas, the problems of diseases of varying sorts affecting plants are still in evidence. Plants continue to be infested with nematodes, and fungus and soil deficiencies still show up in plant growth. Fertilizers therefore have to be applied to plants, aerial spraying still have to be carried out and nemacides and fungicides have to be applied. However, these controls are expensive as the chemicals used are imported at increasingly high costs, thereby making them unavailable to most small farmers.

Perhaps the biggest obstacle to production in the banana industry is praedial larceny. Many farmers are being kept out of agricultural production because of this and they continue to complain that not enough is being done to control or deter this problem.

Roads in most rural areas continue to be in a dilapidated condition and as they remain unattended, they also become a disincentive to farmers to produce, as bad roads increase transportation costs. Farmers also complain of being unable to acquire the correct vehicle to transport their produce. They require small mini-vans as less damage is done to the bananas transported on these small vehicles. However, these vehicles are not being made readily available to the sector.

The problem of the quality and quantity of labour available for work in the industry is perennial. In most rural areas, the social and economic infrastructure to encourage the availability of labour is non-existent. There is a chronic housing and basic amenities shortage and the existence of a good transportation system to enhance labour movements is also lacking. Because of the levels of wages offered to labour in the sector, the quality of labour it attracts is usually characterised by high illiteracy levels which lead to difficult labour relationships. Strikes and other labour unrests affecting production are frequent occurrences and this to a large extent affects the output of the industry.

The price offered to growers for fruit has also been a major disincentive to production. Between 1974 and 1984, even while prices were increasing, production did not, but with significant price increases between 1985-1989, when prices moved from 41¢ to $1.31 per lb. production began to increase. Incentive bonus paymehts have also been initiated both to growers and labour to encourage quality and quantity production.

Markets

Jamaica in the mid 1980's, through its marketing companies in the U.K., embarked on a promotional campaign designed to improve the level of banana consumption in that country. It was geared towards getting across the message that "the banana is a highly nutritious and healthy food, rich in vitamins and fibre but low in calories and fat". The slogan, "**A banana a day the healthy way**" was used. This campaign boosted the demand for West Indian bananas in the U.K

The bulk of the bananas from the English-speaking Caribbean countries is exported under a preferential agreement with the European Economic Community. Under this agreement, Jamaica has a preferential market for 150,000 tons of fruit. At present it supplies only a quarter of this amount but projects that it could supply this market adequately in three to four years.

Caribbean bananas are isolated from the rest of the European market and thus from competition with "dollar zone" bananas. This compartmentalized agreement is not compatible with the free circulation that 1992 will bring. Under the European Economic Community trade harmonization plan, all commodities including bananas entering the community will be treated identically by member countries. This would end preferential market in Britain for its former Caribbean colonies, Jamaica, Windward Islands and Belize.

There is also a prediction that by 1992 there will be an over-supply in the U.K. market However, by then, with the unification of Europe, the market should become larger. If Caribbean preference is eroded re Britain, then there could be the possibility of a larger European Community market, but there would be competition with Central

America, and the American, Caribbean and Pacific countries which have special arrangements with the European Economic Community.

The Caribbean Congress of Labour is agitating via the International Confederation of Free Trade Unions (ICFTU) for the insurance of the banana market for the Caribbean in the European Community come 1992. Caribbean countries are also pressing to maintain their preferential British market after the European Community achieves full trade harmonization in 1992. Indications are that they should be successful.

Outlook for the Industry

The banana industry is making every effort to ensure that by 1992 Jamaica is ready to supply 150,000 tonnes of best quality fruit to the European Community. This fruit has to be produced economically so as to be capable of competing with the "dollar zone".

The industry currently employs 31,000 people and by 1992 should employ 60,000 people. To rehabilitate the industry to realize its target, the following strategies have to be implemented:

(1) Former banana lands are to be brought back into production with small and medium size farmers involved. Production has to be expanded by increasing the acreages under cultivation.

   (a) Production has to be spread around the island so that one section's output will complement the other and failure in one section could be relieved with output in another.

   (b) Additional lands located in St. Mary, St. Thomas, St. Catherine and Hanover are to be brought into production and efforts made to attract entrepreneurs with capacity and know-how to embark on large scale production.

   (c) Technology on efficient banana cultivation is to be transmitted to small and medium scale farmers so as to improve output, and protect and maintain the quality of production.

(2) Nurseries are to be set up in these newly established areas, so as to supply suitable planting materials.

(3) The extension services have to be improved and additional officers utilized where necessary.

(4) Tractors and other agricultural equipment are to be made available to farmers on rent or lease or sale.

(5) Increasing levels of credit at reasonable interest rates should be available to farmers to assist in land acquisition and preparation.

(6) The cost of fertilizers and other chemicals utilized in the industry should be subsidised.

(7) Concerted efforts need to be made at curbing or eradicating praedial larceny within the shortest time span.

(8) The tank-building scheme designed to assist farm families needs to be reactivated.

There is no agricultural product that Jamaica exports which is in short supply on the international market and which is not also produced more competitively elsewhere. This means, that for Jamaica to maintain or increase its market share, it has to produce above international standards, with volumes to hold its market share and at economies of scales which make its production profitable.

The banana industry has a challenge because to expand production requires significant financial outlay. With the present high interest rate levels, unstable market conditions, fluctuating export prices and the overall risk-proneness of the industry to the vagaries of the weather, profitability is difficult to be maintained.

Nonetheless, banana farming is regarded as the most important and useful socio-economic crop of all the agricultural sub-sectors. Properly organised, it can give households the weekly cash-flow necessary for survival. If banana production is pursued with diligence, the export earnings to be derived could close the gap between food imports and agricultural exports. The export quota of 150,000 tons to the European Community in 1992 in quality and quantity could be met by the concerted efforts of all banana farmers.

REFERENCES

The Banana Industry in Jamaica — JIS Pamphlet:

Newspaper Clippings — 1988 & 1989

AIBGA Annual Report — 1963-1988

Bunch — Jamaica Banana Producers Association

The Story of Great Jamaican Enterprise — Jamaica Banana Producers Assn.

Economic & Social Survey Jamaica 1970-1989 — P.I.O.J.

BALANCE OF PAYMENTS DEPARTMENT
B.O.P. AND F.E. MANAGEMENT DIVISION
BANK OF JAMAICA

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THE
JAMAICA BANANA PRODUCERS ASSOCIATION LTD.

REPORT AND ACCOUNTS

31st DECEMBER, 1989

ESTABLISHED 1929.

CONTENTS

NOTICE OF MEETING

NOTICE IS HEREBY GIVEN that the FIFTY-THIRD ANNUAL GENERAL MEETING of THE JAMAICA BANANA PRODUCERS ASSOCIATION LIMITED will be held at the Registered Office of the Company, 6A Oxford Road, Kingston 5, at 11.00 o'clock in the forenoon of Thursday, 16th August, 1990 for the following purposes -

AGENDA

1 To receive and consider the Directors' Report and Statement of Accounts for the year ended 31st December, 1989

2 To fix the remuneration of Auditors for 1989

3 To appoint Auditors for 1991

4 To elect Directors

5 To transact any other competent business

BY ORDER OF THE BOARD

A. E. Ffrench
Secretary

A member of the Company who is entitled to attend and vote is entitled to appoint one or more proxies to attend and on a poll, to vote in his stead. A proxy need not be a member of the Company. Form of Proxy must be lodged at the Registered Office of the Company, not later than forty-eight hours before the Meeting. An appropriate Form of Proxy is enclosed.

Kingston, Jamaica
25th May, 1990

BOARD OF DIRECTORS

C H Johnston, B Sc (Econ)	– Chairman
Marshall McG Hall, C D , Ph D	– Group Managing Director
O F Clarke, B Sc (Econ), F C A	
A E Ffrench	
E C George, Q C , B C L , M A (Oxon)	
H T Hart, B Eng (Elec), M E I C , A M Inst R	
R D Honiball	
R G S Jackson, J P	
E M Johnston	
Mrs Dahlia Kelly, B Sc	
D Lord	
R E Morris, O D , J P.	

DIRECTORS' REPORT

TO BE PRESENTED TO THE STOCKHOLDERS OF
THE JAMAICA BANANA PRODUCERS ASSOCIATION LIMITED
AT THE FIFTY-THIRD ANNUAL GENERAL MEETING OF THE COMPANY

The Directors have much pleasure in presenting their Annual Report and Accounts for the year ended 31st December, 1989

GROUP FINANCES

The Directors are pleased to report that the Group of Companies had a very profitable year. Profit for the year attributable to the Group, amounted to $44,628,000 which was 32% better than that achieved in 1988. Profit before tax amounted to $65,852,000 – 33% better than the previous year. It should be noted, however, that a large part of profits before tax arises from the favourable movements in currency exchange rates between the United Kingdom, U S A. and Jamaica, and it must always be borne in mind that we can also be adversely affected

GROUP ACTIVITIES

Our subsidiary and associated companies in the United Kingdom engaged in the ripening, distribution and sale of bananas and other fruit and vegetables, performed extremely well and made a tremendous impact on overall profits of the Group. Our fruit-juice operation made tremendous strides and the product is now accepted in most of the major supermarket chains in the United Kingdom and an expansion of the operation is being considered. Our Imports division, serving principally the farming community, commenced operations during the year and is trading profitably

We continue to expand our exports of non-traditional food crops to the United Kingdom, and the company was awarded the JAMPRO Trophy for being the most outstanding exporter of fresh produce in 1989. Our exports to the U S market have also been expanded with the inclusion of a wide range of agro-industrial products manufactured in Jamaica

Our two banana projects in St. Thomas and ST. Mary continue as the major suppliers of bananas for export to the United Kingdom. These two projects, as well as our investments in shipping, are all directly related to maintaining our U.K. banana ventures. Indeed, had it not been for the development of the banana projects in Jamaica, we would not have been able to maintain our banana market share in the U K. These projects by themselves are not yet profitable, but the forecasts still indicate that these are viable projects

During 1989, negotiations were concluded to acquire a major interest in a fish-farming enterprise. The project commenced operations but serious security problems showed up, along with an unsatisfactory feed-conversion factor. These two matters however are being addressed. Major refurbishing and re-organization are required and to that end, we are in discussions with the National Investment Bank of Jamaica, our Joint-venture partner in this project

The shipping company continues to provide an excellent service to the agricultural sector, particularly the banana industry, and other sectors of Jamaica's economy and the company is trading profitably. The feasibility of adding a European port to the service, is being con[illegible]

IMPLICATIONS OF 1992

The EEC has determined that, effective the end of 1992, all products, including bananas, should be traded within a single market comprising all twelve EEC countries. If this is completely adhered to, it would mean the end of the preferential banana market for Jamaica and other ACP banana suppliers.

Your company, jointly with other banana marketing companies in the United Kingdom, has mounted a campaign in support of the proposals put forward by the Government of Jamaica and the banana growers that the benefits that now exist under the LOME Agreement be maintained. The EEC themselves have supported this principle and we are optimistic that a solution will be found consistent with the principles enshrined in the LOME Agreement.

DIRECTORS

The Directors retiring by rotation are Mr. R.E. Morris and Mrs. Dahlia Kelly, who being eligible, offer themselves for re-election.

Mr. Aubrey Ffrench [Company Secretary] who was appointed a Director since our last meeting, also retires and being eligible, offers himself for election.

60TH ANNIVERSARY

The company achieved its 60th Anniversary during the year and to mark the occasion, the Directors have approved an outreach programme which will provide substantial benefits in the fields of education and health care.

AUDITORS

Messrs. Peat Marwick have expressed their willingness to continue in office.

MANAGEMENT AND STAFF

The Directors wish to place on record, their appreciation of the services given by the officers and staff during the year under review.

ON BEHALF OF THE BOARD

C.H. JOHNSTON
Chairman

25th May, 1990

FINANCIAL HIGHLIGHTS
FIVE-YEAR SUMMARY

	1985 S'000	1986 S'000	1987 S'000	1988 S'000	1989 S'000
PROFIT AND LOSS ACCOUNT					
Turnover	450,770	486,409	608,080	813,427†	1,054,284
Operating profit	20,144	17,146	27,542	35,875	39,045
Income from investments and associated companies profits	4,720	7,891	8,233	10,482	17,282
	24,864	25,037	35,775	46,357	56,327
Currency exchange gains (losses)	6,730	(1,599)	11,044	3,199	9,525
	31,594	23,438	46,819	49,556	65,852
Taxation	(8,962)	(10,335)	(12,530)	(15,354)	(17,425)
	22,632	13,103	34,289	34,202	48,427
Minority interests	(145)	(105)	(318)	309	(756)
	22,487	12,998	33,971	34,511	47,671
Extraordinary items	11,298	(891)	3,336	(708)	(3,043)
Profit for year attributable to the group	33,785	12,107	37,307	33,803	44,628
Earnings per ordinary stock unit					
Before extraordinary items	310.54c	17.95c*	46.91c	47.66c	65.83c
After extraordinary items	466.56c	16.72c*	51.52c	46.68c	61.63c
BALANCE SHEET					
Fixed assets	34,699	40,814	73,536	82,340	116,149
Working capital	44,505	51,855	55,061	78,223	87,906
Loan capital	(4,401)	(7,401)	(7,901)	(14,230)	(15,541)
Deferred credits	(760)	(651)	(1,083)	(914)	(746)
Deferred taxation	(3,272)	(2,978)	(3,147)	(2,153)	(2,826)
Minority interests	(684)	(789)	(1,321)	(1,490)	(2,647)
Group shareholders' equity	70,087	80,850	115,145	141,776	182,295
Capital	7,241	7,241	7,241	7,241	7,241
Reserves	62,846	73,609	107,904	134,535	175,054
	70,087	80,850	115,145	141,776	182,295
Stock units eligible for dividends	7,241,320	72,413,200*	72,413,200	72,413,200	72,413,200
Stockholders funds per stock unit	$9.68	$1.12*	$1.59	$1.96	$2.52
Stockholders fund per existing stock units	$0.97	$1.12	$1.59	$1.96	$2.52
Buying exchange rates at December 31					
US$1 to J$	5.46	5.46	5.48	5.46	6.46
UK£1 to J$	7.83	7.99	10.14	9.74	10.38

* The issued stock was converted from J$1.00 units to units of 10c each on September 4, 1986

† Restated to conform with 1989 classification

KPMG Peat Marwick

Chartered Accountants

Auditors' Report To the members of
The Jamaica Banana Producers Association Limited

We have examined the financial statements set out on pages 7 to 20 and have obtained all the information and explanations which we required. Our examination was made in accordance with generally accepted auditing standards and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary.

In our opinion, proper accounting records have been maintained and the financial statements, which are in agreement therewith, give a true and fair view of the state of affairs of the company and the group at December 31, 1989 and of the profit and changes in financial position of the group for the year then ended, so far as concerns members of the company, and comply with the provisions of The Companies Act.

Peat Marwick

May 24, 1990

THE JAMAICA BANANA PRODUCERS ASSOCIATION LIMITED

Balance Sheet
December 31, 1989

	Notes	1989 $'000	1988 $'000
CURRENT ASSETS			
Cash		5,406	3,205
Demand loan – subsidiary company		9,504	–
Accounts receivable	4	10,778	22,205
Recoverable taxation		765	585
Inventories	5	2,521	1,564
		28,974	27,559
CURRENT LIABILITIES			
Bank overdrafts and demand loan		9,761	10,249
Accounts payable	6	6,781	4,153
Current maturities of long term loans	14	5,165	3,300
Unclaimed dividends		4,766	2,901
Dividend payable		–	4,345
		26,473	24,948
WORKING CAPITAL		2,501	2,611
INTERESTS IN SUBSIDIARY AND ASSOCIATED COMPANIES	7	32,711	(4,356)
INVESTMENTS	8	1,325	32,967
FIXED ASSETS	10	8,638	6,393
		45,175	37,615
Financed by			
SHAREHOLDERS' EQUITY			
Share capital	11	7,241	7,241
Reserves	12	25,952	19,793
		33,193	27,034
DEFERRED INCOME	13	325	434
LONG TERM LOANS	14	11,657	10,147

On behalf of the Board

C.H. Johnston ..... Chairman

M. Hall ..... Director

		45,175	37,615

The accompanying notes form an integral part of the financial statements

THE JAMAICA BANANA PRODUCERS ASSOCIATION LIMITED

Group Balance Sheet
December 31, 1989

	Notes	1989 $'000	1988 $'000
CURRENT ASSETS			
Cash	14(e)	71,280	62,321
Accounts receivable	4	88,425	93,675
U.K. tax reserve certificates		16,608	11,201
Recoverable taxation		806	731
Inventories	5	17,504	9,525
		194,623	177,453
CURRENT LIABILITIES			
Bank overdrafts and demand loans		18,000	14,224
Current maturities of long term loans	14	5,279	3,404
Taxation		17,366	20,556
Accounts payable	6	61,306	53,798
Unclaimed dividends		4,766	2,901
Dividend payable		–	4,345
		106,717	99,230
WORKING CAPITAL		87,906	78,223
INTERESTS IN SUBSIDIARY AND ASSOCIATED COMPANIES	7	53,507	28,031
INVESTMENTS	8	14,692	17,032
DEFERRED EXPENDITURE	9	–	2,430
FIXED ASSETS	10	47,950	34,847
		204,055	160,563
Financed by			
SHAREHOLDERS' EQUITY			
Share capital	11	7,241	7,241
Reserves	12	175,054	134,535
		182,295	141,776
DEFERRED INCOME	13	746	914
MINORITY INTERESTS		2,647	1,490
DEFERRED TAXATION		2,826	2,153
LONG TERM LOANS	14	15,541	14,230
		204,055	160,563

On behalf of the Board

C.H. Johnston — Chairman

M. Hall — Director

The accompanying notes form an integral part of the financial statements

THE JAMAICA BANANA PRODUCERS ASSOCIATION LIMITED

Group Profit and Loss Account
Year ended December 31, 1989

	Notes	1989 $'000	1988 $'000
GROSS OPERATING REVENUE	15	1,054,284	813,427
Operating profit for the year	16	39,045	35,875
Investment income	17	15,484	7,208
		54,529	43,083
Share of profits of associated companies		1,798	3,274
		56,327	46,357
Currency exchange gains		9,525	3,199
Profit before taxation and extraordinary items		65,852	49,556
Taxation	18	(17,425)	(15,354)
Profit after taxation and before extraordinary items		48,427	34,202
Minority interests		(756)	309
Profit attributable to the group before extraordinary items		47,671	34,511
Extraordinary items, less taxation	19	(3,043)	(708)
Profit for the year attributable to the group	20	44,628	33,803
Transfer to capital reserve	12	(10,732)	(3,894)
		33,896	29,909
Retained profits at beginning of year			
As previously reported		80,695	58,455
Prior year adjustment	3	–	(853)
As restated		80,695	57,602
		114,591	87,511
Dividends	21	(2,432)	(6,816)
Retained profits at end of year	12	112,159	80,695
Retained in the financial statements of			
The Jamaica Banana Producers Association Limited	12	4,899	3,565
Subsidiary companies		114,541	81,490
Associated companies		(7,281)	(4,360)
		112,159	80,695
Earnings per ordinary stock unit	22		
Before extraordinary items		65.83c	47.66c
After extraordinary items		61.63c	46.68c

The accompanying notes form an integral part of the financial statements

Group Statement of Changes in Financial Position
Year ended December 31, 1989

	1989 $'000	1988 $'000
Cash provided (used) by operations		
Profit for the year attributable to the group	44,628	33,803
Adjust items not involving cash		
Deferred expenditure written off	2,430	270
Deferred income	(169)	(169)
Depreciation	7,317	4,729
Deferred taxation	673	994
Profit on disposal of fixed assets	(872)	(2,992)
Gain on sale of shares and investments	(130)	(1,965)
Goodwill written off	–	29
Provision for loss in associated companies	3,212	1,070
Profit retained in associated companies	(574)	(2,248)
Minority interests in retained profits of the year	756	(309)
Change in working capital		
Accounts receivable	5,250	(31,291)
U K tax reserve certificates	(5,407)	2,488
Recoverable taxation	(75)	(610)
Inventories	(7,979)	1,350
Accounts payable	7,506	13,284
Unclaimed dividends	1,864	1,203
Taxation	(3,192)	5,793
Cash provided by operations	55,240	25,429
Cash provided (used) by investment activities:		
Construction in progress	(104)	(23)
Additions to fixed assets	(21,574)	(12,570)
Proceeds from disposal of fixed assets	2,130	3,794
Adjustments to interests in subsidiaries	(94)	431
Proceeds from disposals of shares and long term investments	11,762	7,937
Deferred expenditure	–	(2,700)
Interests in associated companies	(8,496)	438
Additions to investments	(9,292)	(7,057)
Interest in unconsolidated subsidiaries	(5,738)	(2,513)
Cash used by investment activities	(31,406)	(12,263)
Cash provided (used) by financing activities		
Bank overdrafts and demand loans	3,776	13,775
Loan repayments	(1,364)	(1,419)
Long term loans	4,550	11,049
Associated company financing	(15,060)	–
Cash (used) provided by financing activities	(8,098)	23,405
Cash provided before dividend payments	15,736	36,571
Dividends paid	(6,777)	(6,816)
Increase in cash	8,959	29,755

The accompanying notes form an integral part of the financial statements

Notes to the Financial Statements
December 31, 1989

1. The company

The company is incorporated under the Laws of Jamaica and these financial statements are presented in Jamaican dollars

The main activities of the company and its subsidiaries, as listed on page 20, are the marketing and distribution of bananas and other fresh produce locally and overseas, agricultural production, shipping, the holding of investments and the operation of a travel agency

2. Significant accounting policies

(a) Accounting convention

The financial statements are presented under the historical cost convention, modified for the inclusion of certain fixed assets at valuation

(b) Basis of consolidation:

The consolidated financial statements include the financial statements of all subsidiaries except as detailed in note 7, made up to December 31, 1989

Associated companies, as listed on page 20, are reported on the equity basis (see notes 3 and 7)

All significant inter-company transactions are eliminated

Goodwill arising on the acquisition of the subsidiaries is written off directly to reserves in the year in which it arises

The company and its subsidiaries are collectively referred to as the "Group"

(c) Determination of profit and loss

Profit is determined as the difference between the revenues from the goods and services rendered and the costs and other charges incurred during the year. Profits on transactions are taken in the year in which they are realised. A transaction is realised at the moment of delivery. Losses are taken in the year in which they are realised or predeterminable

(d) Depreciation

Fixed assets, with the exception of freehold land on which no depreciation is provided, are depreciated on both straight line and reducing balance bases at annual rates varying between 2% to 33⅓% estimated to write off the assets over their expected useful lives. Computer equipment is depreciated on a straight line basis at 33⅓% and 100% per annum and also at 20% per annum on a reducing balance basis

(e) Inventories

Inventories are valued at the lower of cost, determined principally on a first-in first-out basis, and net realizable value

Upheld expenditure, which represents crop cultivation expenses, will be matched against the proceeds of the crop to which they relate, and is stated at prime cost

Livestock is at a valuation given by the directors. The basis of valuation is consistent and in accordance with the basis recommended by the Income Tax Department

(f) Foreign currencies

The Group's foreign fixed assets and investments are translated at historical rates

The Group's foreign current assets and liabilities are translated at J$10.38 (1988 - J$9.74) to £1 and J$6.46 (1988 - J$5.46) to US$1, being the buying rates of exchange ruling at the balance sheet date

Other transactions in foreign currencies are converted at the rates of exchange ruling at the date of those transactions

Other than for depreciation on fixed assets, which is computed at the historical rate applicable to the particular asset, other items in the foreign subsidiaries' profit and loss accounts are translated at an average rate of J$10.13 (1988 - J$10.00) to £1 and J$5.98 (1988 - J$5.49) to US$1 being the average rate of exchange ruling for the year

Gains and losses arising from fluctuations in exchange rates are included in the profit and loss account. Unrealized portions of such gains are ultimately transferred to capital reserve

(g) Deferred taxation

The recognition of all reversible timing differences between reporting of income and expense items for taxation and financial statements purposes whenever material are accounted for at current rates through a deferred taxation account

3. Change in accounting policy

At December 31 1988 the group took up its shares of A S Noja Limited s and its two associated companies equity and all reserves in accordance with recognised accounting practice Up to December 31 1987 the group brought to account its share of the shareholders equity Premium received on a subsidiary company s leased property is shown in extraordinary item to conform with the parent company s treatment As a result 1987 comparative statistics for associated company and reserves balances were restated to conform with 1988 (see notes 7 and 12)

4. Accounts receivable

Accounts receivable include

(i) $54 941 (1988 $70 583) for the company and $54 941 (1988 $78 138) for the group in respect of business travel advances made to directors of the company, which have subsequently been expensed

(ii) $Nil (1988 $17 988) due from associated companies for the group

5. Inventories

	Group		Company	
	1989 $'000	1988 $'000	1989 $'000	1988 $'000
Export merchandise	172	-	172	-
Import merchandise	1,366	-	1,366	-
Livestock	314	312	301	311
Upheld expenses	128	209	-	-
Banana stock and sundries	10,594	6,374	-	-
Other	4,930	2,630	682	1,253
	17,504	9,525	2,521	1,564

6. Accounts payable

Accounts payable include $157 (1988 $11,262) for the company and $5,314 (1988 $16,419) for the group due to the directors of the company and $1,000 000 which will be refinanced by a mortgage loan for which a commitment letter has been received

7. Interests in subsidiary and associated companies

	Group		Company	
	1989 $'000	1988 $'000	1989 $'000	1988 $'000
Subsidiary companies				
Shares at cost less amount written off	5,318	-	12,574	7,255
Loan accounts	-	-	32,582	3,037
Current accounts	420	-	(39,680)	(29,349)
	5,738		5,476	(19,063)
Associated companies				
Shares at cost less amount written off	16,924	15,545	14,187	14,187
Group s share of				
Post-acquisition reserves	(7,281)	(4,360)	-	-
Pre-acquisition reserves	683	683		
Other reserves (see note 3)	16,475	14,160	-	
Loan accounts	10,428	-	7,896	
Current accounts	10,540	2,003	5,152	520
	47,769	28,031	27,235	14,707
	53,507	28,031	32,711	(4,356)

A 66 2/3% interest in Jamaica Producers Aqualapia Limited was acquired with effect from July 1 1989 under a debt equity swap agreement The first set of financial statements will be prepared for this subsidiary for the eighteen month period ending December 31 1990

An associated company, Balmoral Banana Company Limited, closes its books on March 31 each year. The consolidated profit and loss account includes the group's share of profit of the company based on the management accounts for the year ended December 31, 1989. The results of the company are insignificant in relation to the group.

8. Investments

	Group		Company	
At cost	1989 $'000	1988 $'000	1989 $'000	1988 $'000
(a) Quoted – trade	5,705	6,753	–	
– long term	2,155	1,615	1,109	592
(b) Unquoted – trade	6,255	160	5	5
– long term	57	562	45	562
(c) Long term receivables				
Loans to employees for purchasing stocks in the company	22	33	22	33
Mortgage loans for staff housing	150	171	105	108
National Housing Trust recoverable in the years 2001-4	114	114	39	39
(d) Other long term loans	234	7,624	–	31,628
	14,692	17,032	1,325	32,967
Estimated market value of quoted investments	22,088	11,244	8,607	4,410

Market values of quoted investments are computed based on quotations received from investment brokers.

It is the opinion of the directors that the value of all other investments exceeds cost.

9. Deferred expenditure

	Group		Company	
	1989 $'000	1988 $'000	1989 $'000	1988 $'000
At beginning of year	2,430	–	–	–
Amount paid for the usage of the Atlantic shipping route	–	2,700	–	–
Less Amount written off	2,430	270	–	–
	–	2,430	–	–

10. Fixed assets

(a) Group	Freehold land and buildings	Leasehold land	Furniture, Equipment and vehicles	Total
	S'000	S'000	S'000	S'000
At valuation				
Pre-1984	75	–	–	75
1984	2,800	–	–	2,800
At cost	7,416	7,420	30,092	44,928
December 31, 1988	10,291	7,420	30,092	47,803
Additions	1,845	2,503	17,226	21,574
Construction in progress	104	–	–	104
Disposals	(178)	–	(3,121)	(3,299)
December 31, 1989	12,062	9,923	44,197	66,182
At cost	9,187	9,923	44,197	63,307
At valuation	2,875	–	–	2,875
	12,062	9,923	44,197	66,182
Depreciation				
December 31, 1988	996	550	11,410	12,956
Charge for the year	323	500	6,494	7,317
Eliminated on disposals	(12)	–	(2,029)	(2,041)
December 31, 1989	1,307	1,050	15,875	18,232
Net book values				
December 31, 1989	10,755	8,873	28,322	47,950
December 31, 1988	9,295	6,870	18,682	34,847
(b) Company				
At cost				
December 31, 1988	5,479	–	2,232	7,711
Additions	1,766	–	1,068	2,834
Disposals	–	–	(74)	(74)
December 31, 1989	7,245	–	3,226	10,471
Depreciation				
December 31, 1988	482	–	836	1,318
Charge for the year	210	–	378	588
Eliminated on disposals	–	–	(73)	(73)
December 31, 1989	692	–	1,141	1,833
Net book values				
December 31, 1989	6,553	–	2,085	8,638
December 31, 1988	4,997	–	1,396	6,393

Freehold land and buildings for the group include land at a valuation of $1,476,333 (1988 $970,596) and the directors' estimate of cost of $1,807,237 (1988 $2,249,391) for the group and $1,702,237 (1988 $1,562,058) for the company

11. Share capital

	Group & Company	
	1989	1988
	$'000	$'000
Authorized: 200,000,000 shares of 10c each	20,000	20,000
Issued and fully paid in stock units of 10c each	7,241	7,241

The Board granted options to some members of the company's senior staff to acquire

(a) 72,413 new shares at $3.90 per share. The options are exercisable between May 1, 1990 and October 31, 1990.

(b) 72,413 new shares at $2.65 per share between March 18, 1991 and September 17, 1991, and

(c) 72,413 new shares at $2.00 per share between November 16, 1991 and May 15, 1992.

The options are exercisable if such employees are still working for the company at the relevant option dates.

12. Reserves

	Group		Company	
	1989	1988	1989	1988
	$'000	$'000	$'000	$'000
Capital				
Share premium	38	38	38	38
Other				
At beginning of year				
As previously reported	53,802	40,949	16,190	16,791
Prior year adjustments (see Note 3)	–	9,315	–	–
As restated	53,802	50,264	16,190	16,791
Adjustment for change in group structure	(1,677)	(356)	–	–
Transfer (to) from profit and loss account				
Gain on fire insurance claim	–	(1)	–	–
Unclaimed dividends	103	63	103	63
Share of associated company reserves (see note 3)	3,495	4,905	–	–
Currency translation gains	6,629	5,405	4,311	6,006
Gain on disposal of shares	33	205	–	74
Net premium received on leased property	169	169	108	108
Capital distribution received (net)	12	27	12	27
Capital distribution (gross)	(2,534)	(6,879)	(2,534)	(6,879)
Gain on sale of premises in 1988	2,825	–	2,825	–
At end of year	62,857	53,802	21,015	16,190
Revenue				
Retained profits	112,159	80,695	4,899	3,565
	175,054	134,535	25,952	19,793

Unappropriated profits at December 31, 1989 include $32,516 (1988 $32,516) for the group and $32,016 (1988 $32,016) for the company, franked income available for distribution.

13. Deferred income

This comprises premium received on leased land for which credits of $108,504 and $60,000 are being taken for each year over a period of 10 years ending 1992 and 1996 respectively.

14. Long term loans

	Group		Company	
	1989 $'000	1988 $'000	1989 $'000	1988 $'000
(a) Mortgage loan	1,590	1,694	-	-
(b) Bank loan	2,408	2,493	-	-
(c) Promissory note	2,996	2,996	2,996	2,996
(d) Jamaica Agricultural Development Foundation loan	276	276	276	276
(e) Bank loan	11,314	10,175	11,314	10,175
(f) Bank loan	2,236	-	2,236	-
	20,820	17,634	16,822	13,447
Less current maturities	5,279	3,404	5,165	3,300
	15,541	14,230	11,657	10,147

(a) The mortgage loan is secured by a first charge on a subsidiary's freehold premises. This loan is repayable by April 30, 1996, and bears interest at 22% per annum.

(b) The bank loan is secured by a charge over a subsidiary company's leasehold premises. It is repayable by ten equal annual instalments commencing February 26, 1988. Interest is charged at the higher of 10% per annum or 2% above the United Kingdom bank base rate.

(c) The promissory note is payable on October 23, 1991. However, the company can give seven days notice and repay $100,000 or multiples of this amount up to the total amount outstanding. Interest is payable at 29% per annum (1988: 22%).

(d) Jamaica Agricultural Development Foundation loan was obtained in 1987 for three years at 12% per annum, calculated daily, interest rate. This loan is used to procure inputs for a small-farmer banana pilot project. It is secured by a crop lien and carries a one-year grace period for principal and interest.

(e) The bank loan is repayable by thirteen quarterly instalments of $975,000 up to February 1992. Interest is calculated on the daily balance outstanding at varying rates. The average rate for 1989 was 10.18% (1988: 9.41%). Cash includes a deposit of $11,951,000 (1988: $10,101,000) which is secured by a letter of assignment given to a subsidiary company's bankers in support of this loan.

(f) The bank loan is repayable by an initial instalment of $975,000 and sixteen quarterly instalments of $227,500 which commenced on May 25, 1989. Interest is calculated on the daily balance outstanding, at varying rates. The average rate for 1989 was 11.57% (1988: nil%).

15. Gross operating revenue

Gross operating revenue comprises the gross sales of goods and services of the group, commission earned by the group on consignment sales after deduction of returns and U.K. value added tax and investment income. 1988 statistics are restated to include investment income.

16. Operating profit

Operating profit for the year is stated after charging (crediting):

	1989 $'000	1988 $'000
Depreciation	7,317	4,729
Directors' emoluments:		
For services as directors	82	73
For executive services	396	334
Auditors' remuneration	1,080	930
Interest:		
- long term loan	3,173	2,048
- other	3,635	1,189
Profit on disposal of fixed assets	(872)	(2,992)
Lease	87	497

17. Investment income

	1989 $'000	1988 $'000
Profit on sale of shares and investments	130	205
Dividend received		
– gross (quoted)	428	239
– gross (unquoted)	84	41
– capital distribution (gross)	12	29
Interest	14,782	3,632
Other	48	3,062
	15,484	7,208

18. Taxation

Taxation is based on the profit for the year adjusted for tax purposes and is made up as follows

	1989 $'000	1988 $'000
Income tax @ 33⅓%	9,318	7,973
Transfer tax @ 7½%	1	–
Taxation on share of profits of associated companies	1,224	1,026
Exchange translation loss (gain)(b)	249	(207)
Unrelieved U K tax	703	619
United Kingdom Corporation tax @ 35%	5,608	6,436
Flat rate Corporation tax	24	19
	17,127	15,866
Deferred taxation	531	(878)
	17,658	14,988
Adjustment in respect of previous years	(233)	366
	17,425	15,354

(a) The charge for Jamaica's income tax is 33⅓% of the profit for the year, adjusted for tax purposes

The effective tax rate for 1989 was 26.46% (1988: 30.98%) of $65,852,000 (1988: $49,556,000) pre-tax profits compared to a statutory tax rate of 33⅓% (1988: 33⅓%). The actual expense differed from the "expected" tax expense for those years as follows:

	1989 $'000	1988 $'000
Computed "expected" tax expense	21,951	16,519
Difference between profit for financial statements and tax reporting purposes on –		
Overseas taxation	339	285
Currency translation gains	(2,210)	(1,802)
Disallowed expenses, depreciation and other related capital adjustments	(2,655)	352
Actual tax expense	17,425	15,354

(b) Arises from the translation of the U K balance sheet, deferred taxation and corporation tax liabilities which are payable on January 1, 1991 (1988: January 1, 1990)

(c) Tax losses available for offset against future profits amounted to $4,201,755 (1988: $8,957,044) for the group and $Nil (1988: $3,110,000) for the company, with $2,478,155 (1988: $1,914,699) of these losses being specifically available for offset against profits generated from agricultural activities

(d) The company and a subsidiary were granted relief from taxation on agricultural income derived from the growing of sugar cane, coconuts, citrus, pimento and bananas under the provisions of the Income Tax (Approved Farmer) Order 1984. This relief covers ten years which commenced September 1984

19. Extraordinary items, less taxation

	1989 S'000	1988 S'000
Provision for loss in associated company	(3,212)	(1,070)
Capital distribution received, gross	–	29
Premium received on leased property	169	169
Gain on sale of shares and investments	–	196
Goodwill written off	–	(29)
Gain from fire insurance claim	–	(1)
	(3,043)	(706)
Transfer tax on capital distribution received	–	(2)
	(3,043)	(708)

20. Profit for year attributable to the group

Profit dealt with in the financial statements of the parent company – $8,590,518 (1988 $7,240,604)

21. Dividends

	1989 S'000	1988 S'000
Capital distribution		
First interim paid in respect of 1989 – 3½c (1988 3½c) per stock unit – gross	2,534	2,534
Second interim payable in respect of 1988 – 6c per stock unit – gross	–	4,345
	2,534	6,879
Ordinary		
Unclaimed dividends written back	(102)	(63)
	2,432	6,816

22. Earnings per ordinary stock unit

The earnings per ordinary stock unit is calculated by dividing the profit for the year attributable to the group before and after extraordinary items respectively, by the total of 72,113,200 ordinary stock units of 10 cents each. Fully diluted earnings per share is not calculated as the outstanding options are immaterial.

23. Pension scheme

(a) The company operates a 'benefits based' trusteed pension scheme covering certain salaried employees of the company and its Jamaican subsidiaries, who have satisfied minimum service requirements.

The scheme is subject to an actuarial valuation every three years. The most recent actuarial study was done as at December 31, 1987, when a net liability to be met by the employer of $1,654,000 for past and future service was indicated. An employer's contribution rate of 5.5% of total pensionable salaries was recommended. The company's current contributions are adequate. This will fund the long term benefits of the plan. The next actuarial valuation is due at December 31, 1990.

The company paid $245,944 (1988 $174,716) for the company and its Jamaican subsidiaries. This amount includes $138,845 (1988 $70,211) for this company.

(b) A subsidiary company operates a pension scheme for eligible employees, including directors, in the United Kingdom, based on final pensionable earnings.

The assets of the scheme are held separately from those of the group being invested with the insurance company which manages the funds. Contributions to the scheme, determined by the insurance company's actuary on the basis of triannual valuations using the projected unit method, are charged to the profit and loss account so as to spread the cost of pensions over employees' working lives with the company.

The most recent actuarial valuation was at January 1, 1988 and showed that the value of the scheme's assets was $23,832,480 representing 165% of the benefits that had accrued to

THE JAMAICA BANANA PRODUCERS ASSOCIATION LIMITED

Group Companies
December 31, 1989

	Percentage of issued equity capital held	
	1989	1988
SUBSIDIARY COMPANIES		
Jamaica Banana Producers Steamship Company Limited	100	100
Agualta Vale Limited	100	100
Water Valley Limited	100	100
Producers Travel Service Limited	100	100
The Jamaica Producers Marketing Company Limited	100	100
J.P. Fruit Distributors Limited	100	100
Broome & Greene (London) Limited [ceased trading during 1986]	100	100
Oceanfall Limited	100	100
J P Limited	100	100
White and Son (Sales) Limited	100	100
J P Shipping and Distribution Limited	100	100
J P Produce Holdings Limited	100	100
Sunburst Commodity Trading Limited	100	100
Sun Exotics Limited	85.71	85.71
Frank H. Mann (Torquay) Limited	100	100
Frank H. Mann (Barnstaple) Limited	100	100
Frank H. Mann (Saltash) Limited	100	100
Producers Fruit Distributors Limited	51	51
Jamaica Producers Ripening Company Limited	67	67
JBFS Investments Limited	67	67
Crescent Developments Limited	67	67
Southern Shipping Company Limited	66⅔	66⅔
P.S.C. Limited	60	60
Jamaica Producers Shipping Company Limited	100	100
Jamaica Producers Marketing (U.S.A.) Inc	100	100
Produce Storage Limited	100	100
Oakworth Holdings Limited	100	100
J.P. Services Limited	66⅔	-
Jamaica Producers Aqualapia Limited		
ASSOCIATED COMPANIES		
Bradshaws (Bolton) Limited	39.86	31.86
A.S. Noja Limited	40	40
Noble Chemicals II S.A.	-	25
Noble Gas Shipping I S.A.	-	30
Balmoral Banana Company Limited	45	45
Eastern Banana Estates Limited	20	20
Island Exotics Limited	50	50
St. Mary Banana Estates Limited	50	50
Sunjuice Limited	47.5	50

members. In arriving at these valuations it was assumed that the investment returns would be 9% per annum and salary increases would average 7% per annum. However, the surplus funding does not take into account the request of the Directors to the trustees to enhance certain benefits with effect from January 1, 1989 to bring them into line with other similar schemes.

The contributions for the year debited to the UK subsidiary companies' profit and loss account amounted to $1,433,193 (1988 - $1,211,218).

24. Contingent liabilities

There are contingent liabilities at December 31, 1989 in respect of:

(a) Guarantee covering amounts payable for U.K. customs and excise duty on bananas imported to the U.K. in the absence of shipping documents, amounting to $4,257,185 (1988 - $3,944,700) for the group.

(b) A subsidiary company is a member of the Banana Group, a company limited by guarantee formed to increase the sales of bananas in the U.K. In the event of that company becoming insolvent, this subsidiary company will be liable to pay up to a maximum of $207,600 (1988 - $194,800).

(c) Arrears of preference dividends payable by a subsidiary to the parent company for 1989 amounted to $Nil (1988 - $2,550).

(d) Taxation assessments in a subsidiary amounting to approximately $30,000 (1988 - $30,000) which is currently under notice of objection.

25. Commitments

(a) Unexpired lease commitments at December 31, 1989 expire as follows:

	Group		Company	
	1989 $'000	1988 $'000	1989 $'000	1988 $'000
Within one year	644	564	-	46
Subsequent years	1,249	1,687	-	-
	1,893	2,251	-	46

(b) The Board of Directors:

(i) approved for the company additional investment of $17million (1988 - $4 million) in an associated company. This amount is not committed.

(ii) approved and committed for the company $Nil (1988 - $6 million) for the acquisition of Jamaica Producers Aqualapia Limited, a fish farming operation.

(iii) approved $600,000 (1988 - $Nil) for the acquisition of a residential building.

(iv) authorised capital expenditure for subsidiary companies amounting to $14,646,180 (1988 - $13,616,520) of which $Nil (1988 - $Nil) was committed.

26. Subsequent event

Effective January 31, 1990, the selling exchange rate of the Jamaican dollar was fixed at US$1.00 to J$7.00. The selling rate at December 31, 1989 was US$1.00 to J$6.50. This has the effect of increasing the net shareholders' equity at May 24, 1990 by approximately $2,433,000 for the company and $8,927,000 for the group.

PRODUCTION COSTS FOR BANANA, PAPAYA, GUAVA AND ORANGE

MANGO (Mangifera indica) - PRODUCTION COST FOR ONE ACRE

ITEMS	UNIT	# OF UNITS	RATE	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8 -15		
LABOUR COST													
Land clearing	tractor hr.	2	$100.00	200									
Land preparation	tractor hr.	5	$100.00	500									
Irriga. install. & maintenance		$20/MD		40	40	40	40	40	40	40	40		
Cutting pegs & lining	MD	2	$30.00	60									
Digging holes	each	90	$1.20	108									
Planting	each	90	$0.80	72									
Weed control	MD		$30.00	240	240	[illegible]	120	120	120	120	120		
Apply fertilizer & manure	MD	3	$30.00	90	90	90	90	90	90	90	90		
Pest & disease control	MD	8	$30.00	240	240	240	240	240	240	240	240		
Training & pruning	MD	3	$30.00	90	90	90	90	90	90	90	90		
Harvesting	boxes		$1.50	0	0	0	540	1,080	1,620	2,430	3,240		
Grade & pack	boxes		$0.75	0	0	0	270	540	810	1,215	1,620		
Transportation - seedlings	each		$0.50	[illegible]									
products	boxes		$1.50	0	0		540	1,080	1,620	2,430	3,240		
Sub-Total				1,697	750	590	1,935	3,285	4,620	6,055	8,185		
MATERIALS													
Irrigation equipment	$640.00/yr.			640	640	640	640	640	640	640	640		
Plants (5% for losses)	$12.00 each			1,224									
Fertilizer	$55/cwt.			44	88	132	176	220	265	308	265		
Insecticides & fungicides	$82.00/lb			82	123	195	277	415	620	934	1,401		
Weedicides				170	170	85	85	85	85	85	85		
Carton boxes	boxes		$3.00				1,080	2,160	3,240	4,887	6,480		
Sub-Total				2,077	1,021	1,042	2,258	3,520	4,852	6,796	9,377		
OTHER CHARGES													
Tools (5% of materials)				104	51	52	113	176	243	339	466		
Supervision (10% lab. & mat.)				376	177	163	419	680	948	1,244	1,755		
Interest on work. cap. (20% lab. & mat.)				751	344	324	836	1,365	1,897	2,488	3,510		
Land taxes				45	45	45	45	45	45	45	45		
Plant insurance (5% lab. & mat.)				188	89	81	209	340	474	672	878		
Contingency (5% labour & material)				188	89	81	209	341	474	672	878		
Sub-Total				1,646	783	741	1,829	2,924	4,076	5,755	7,534		
TOTAL PRODUCTION COST				5,404	2,571	2,363	6,017	9,728	13,553	18,606	25,055		
REVENUE						3,240	8,640	17,280	22,680	34,020	42,120		
GROSS RETURNS				(5,404)	(2,571)	877	2,623	7,542	9,121	14,914	17,065	17,065	17,065

ASSUMPTIONS:

(1) Plant population - 90 plants acre (22' x 22')

(2) Boxes hold 9, 12 or 15 fruits (average 12/box)

(3) Fertilizer application - 1 lb. per tree in year one (1) and this is increased by 1 lb. yearly to a maximum of 6 lbs.

(4) Marketable yield/tree (export fresh fruit) plus Marketable yield/tree (local market)

		Year 3	- 1 doz./tree
Year 4	- 4 doz./tree	Year 4	- 1 doz./tree
Year 5	- 8 doz./tree	Year 5	- 2 doz./tree
Year 6	- 12 doz./tree	Year 6	- 2 doz./tree
Year 7	- 18 doz./tree	Year 7	- 3 doz./tree
Year 8-12	- 24 doz./tree	Year 8-12	- 3 doz./tree

(5) Fruits are packed in boxes on the farm and are purchased by an exporter at a price of $15/box.

SWEET ORANGE - PRODUCTION COST FOR ONE ACRE

ITEMS	RATE	UNIT	# OF UNIT	YEAR 1	YEAR 2	YEAR 3	YEAR 4
LABOUR							
Land clearing	$100	tractor hr.	2	200			
Land preparation	$100	tractor hr.	5	500			
Irriga. install. & maint.				80	80	80	80
Lining operation	$30	MD	2	60			
Making mounds	$1.20	@	264	317			
Construct & maintain drain	$30	MD	3	90	60	60	60
Planting	$0.80	@	264	211			
Fertilizer application	$30	MD	4	120	120	120	120
Weed control (chemical)	$30	MD		120	120	90	90
Pest/disease control	$30	MD	5	150	150	150	150
Pruning & training	$30	MD		60	90	60	120
Irrigating	$30	MD	5	150	150	150	150
Harvesting	$1.50	boxes				99	297
Transportation - seedlings	$0.50	@	277	139			
products	$1.50	boxes		0	0	99	297
Sub-Total				2,197	740	908	1,364
MATERIAL							
Irrigation equipment	$640.00/yr			640	640	640	640
Fertilizer	$55/cwt			92	162	227	357
Plants (plus 5% for losses)	$10/plant			2,772			
Insecticide & fungicide	$82.00/lb			2,706	2,706	3,608	3,608
Herbicide	$170/gal			680	510	340	510
Sub-Total				6,895	4,018	4,815	4,995
OTHER CHARGES							
Tools (5% of materials)				345	201	241	249
Supervision 10% (labour + material)				909	476	570	631
Interest on work. cap. (20% lab + mat)				1,818	952	1,140	1,262
Plant insurance (5% lab. & mat.)				455	238	286	316
Contingency (5% lab. & mat.)				455	229	286	315
Land taxes				40	40	40	40
Sub-Total				4,021	2,144	2,570	2,811
TOTAL COST				13,113	6,902	8,293	9,169
REVENUE				0	0	2,970	8,910
GROSS RETURNS				(13,113)	(6,902)	(5,323)	(259)

ASSUMPTIONS:

1. Plant population - 264 plants/acre (11' x 15')
2. Yield: Year 3 - 66 boxes/acre
   Year 4 - 198 boxes/acre
   Year 5 - 264 boxes/acre
   Year 6 - 396 boxes/acre
   Year 7 - 528 boxes/acre
   Year 8 - 660 boxes/acre
   Year 9 - 792 boxes/acre
   Year 10-20 - 924 boxes/acre
3. Farmgate price per box - $525.00 for sale to processing plant and $450.00 to hucksters.
4. Marketable yield - 90% of production
5. Fertilizer: (N,P,K - 16:9:18)
   Year 1 - 198 lbs/ac
   Year 2 - 330 lbs/ac
   Year 3 - 462 lbs/ac
   Year 4 - 726 lbs/ac
   Year 5 - 990 lbs/ac
   Year 6 - 1,254 lbs/ac
   Year 7 - 1,518 lbs/ac
   Years 8-20 - 1,650 lbs/ac
7. Estimated life of crop - twenty (20) years
8. Sales to the processing plants starts in Year 8 at 50:50.

SOLO PAPAYA - PRODUCTION COST FOR ONE ACRE

ITEMS	RATE	UNIT	# OF UNITS	YEAR 1	YEAR 2	YEAR 3
LABOUR COST						
Land clearing	$100	tractor hr.	2	200		
Land preparation	$100	tractor hr.	5	500		
Line out & digging of holes	40 c	H	640	256		
Apply pre-emergent herbicide	$30	MD	1	30		
Planting	$30	MD	4	120		
Circle weeding (4 times)	20 c	H	640	128		
Pest & disease control	$30	MD	6	180	180	180
Herbicide application	$30	MD		180	150	150
Fertilizing	$30	MD		180	180	120
Drip irrig. instal. & main.	$30	MD		180	120	120
Prune	$30	MD		120	60	30
Pack & grade	4 c	lb		620	1,240	521
Transportation	2 c	lb		310	620	260
SUB-TOTAL				3,004	2,550	1,381
MATERIALS						
Irrigation				640	640	640
Seedlings	$0.[illegible]	plant	1,860	1,581		
Fertilizers	$55.[illegible]	cwt	30	2,349	3,716	1,477
Pesticides & Herbicides	$60.[illegible]	lb		720	720	480
SUB-TOTAL				5,290	5,076	2,597
OTHER CHARGES						
Supervision (10% labour & materials)				829	763	397
Land taxes				40	40	40
Tools/5% labour & material				415	381	199
Interest on working cap. 20% (lab. & mat.)				1,659	1,525	795
Plant insurance (5% lab. & mat.)				415	381	199
Contingency (5% lab. & mat.)				415	381	199
SUB-TOTAL				3,772	3,472	1,829
TOTAL COST OF PRODUCTION				12,066	11,097	5,807
REVENUE				24,800	49,600	20,832
GROSS RETURNS				12,734	38,503	15,029

ASSUMPTIONS:

1. Plant population - 620 plants per acre (7' x 10').
2. Yield:
   Year 1 - 15,500 lbs per acre (25 lbs. per tree)
   Year 2 - 31,000 lbs per acre (50lbs. per tree)
   Year 3 - 13,020 lbs per acre (30 lbs. per tree)
   (by year 3 approximately 30% of the trees will have died)
3. Price of papaya $12.00 per lb. (Farmgate).
4. Chemicals - 4 lbs. of pesticides and herbicides per acre at
   17 applications per year using a three (3) week spraying cycle.
   Estimated price of chemical - $640.00 per lb
5. Fertilizer application:
   - 1,000 lbs. of triple superphosphate pre-planting application.
   - 14,250 lbs. of (12-10-18) N.P.K. applied throughout life of the crop.
6. Weed control - accomplished by circle weeding by hand and herbicides.

BANANA (Musa sapientum)
COST OF PRODUCTION & RETURNS FOR ONE ACRE (J$)

ITEMS	UNIT	NUMBER OF UNITS	RATE	YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
LABOUR COST									
Land preparation	Acre	1	1,100	1,100					
Lining, Digging & Planting	Acre	800	126.00	100,800					
Cut pegs	NO.	800	0.03	24					
Clean suckers & inspect	NO.	800	0.06	48					
Head suckers	NO.	800	0.05	40					
Weed control	NO.	3	80		240	240	240	240	240
Fertilizing	Acre	1	1,311	1,311					
Nematode control	Acre	1	885		885	885	885	885	885
Leaf spot control	Acre	1	219	219					
Drain construction & cleaning	Acre	1	435	435					
Sleeving	NO.	800	0.09		72	72	72	72	72
Deflowering, leaf sanitation & sucker training	Cycles	35	5		135	135	135	135	135
Purchasing of twine	NO.	3	[illegible]	[illegible]					
Pruning	Acre		154		154	154	154	154	[illegible]
Harvesting & carting	Acre	1	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Transport	Acre	1	154		154	154	154	154	154
Contingency 10%				10,411	181	181	181	181	181
TOTAL LABOUR COST				12,512	1,748	1,748	1,748	1,748	1,748
MATERIAL INPUTS COST									
Suckers	NO.	800	2	1,600					
Gramoxone	Gallon	1.13	155.45		176	176	176	176	176
Sulphate of Ammonia	Ton	0.15	711.45		107	107	107	107	107
Vydate L	Gallon	4.50	214.94		967	967	967	967	967
Sleeves 0.5	NO.	800	0.96		768	768	768	768	768
Guying Twine	Rolls	4	77		278	278	278	278	278
Benlate	lbs.	4.25	73		310	310	310	310	310
Spray Oil	Gallon	21.25	12		260	260	260	260	260
Packing materials (@J$8.28/Box)	Boxes		8.28		4,198	5,167	5,167	5,167	5,167
Other materials for packing	Boxes				461	569	569	569	569
Miscellaneous					590	580	580	580	580
Crop Insurance					430	529	529	529	529
Land Tax			40		40	40	40	40	40
Contingency 10%				160	856	975	975	975	975
TOTAL MATERIAL INPUT COST				1,600	8,577	9,751	9,751	9,751	9,751
TOTAL COST				14,112	10,324	11,499	11,499	11,499	11,499
REVENUE				12,096	16,045	19,748	19,748	19,748	19,748
GROSS RETURNS				(2,017)	5,721	8,249	8,249	8,249	8,249

ASSUMPTIONS:

1. Plant population - 800 plants per acre
2. Variety used - Williams, Valery
3. Net Yield:
   - Year 1 - 4.9 tonnes per acre
   - Year 2 - 6.5 tonnes per acre
   - Year 3-5 - 8.0 tonnes per acre
4. Price - $1.12/lb.
5. 1 Tonne = 2,204 lbs.
6. Chemicals:
   - Weedicides - Gramazone @ $130.00 per gallon
   - Fertilizers - Sulphate of Ammonia @ $711.45/ton - NPK(15-5-35) @ $309.41/ton
   - Nematicides - Vydate L @ $214.94/gal.
   - Leaf Spot Control - Calixin @ $154/litre
     Triton @ $238.15/gal. (sticker)
     Benlate D.D. @ $73.84/lb.
7. Other Materials for packing - Include bleach, ink, banana knives and crown pads.
8. Price of Sleeves:- 3 Types
   - .5 - $800.56 per 1,000
   - .7 - $1,132.36 per 1,000
   - Milky .75 - $1,045.06 per 1,000

   * These prices are subject to change and can be adjusted downwards depending on how much is bought and in what volume.

9. Exportable yields are achieved in Year 2

10. Miscellaneous Items include windbreak and soil and foliar analysis.

11. Replanting of fields is not necessary until year 6 once the crop is properly managed and cared and there are no major diease problems.

12. Grown under rainfed conditions.

13. Method of harvesting/packing: Field Pack

14. Year 0 is assumed to be the implementation period.