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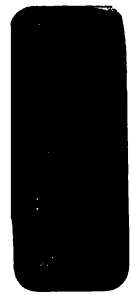


**IICA**



**TRANSFORMATION OF TROPICAL  
FRUITS FOR THE CARIBBEAN  
FINAL REPORT ON A SURVEY  
IN THE  
ENGLISH AND DUTCH-SPEAKING  
CARIBBEAN**

Prepared by: Judith Ann Francis<sup>1</sup>





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Prepared by: Judith Ann Francis<sup>1</sup>

March 1995

<sup>1</sup>CARIRI - Trinidad and Tobago

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# **TRANSFORMATION OF TROPICAL FRUITS FOR THE CARIBBEAN**

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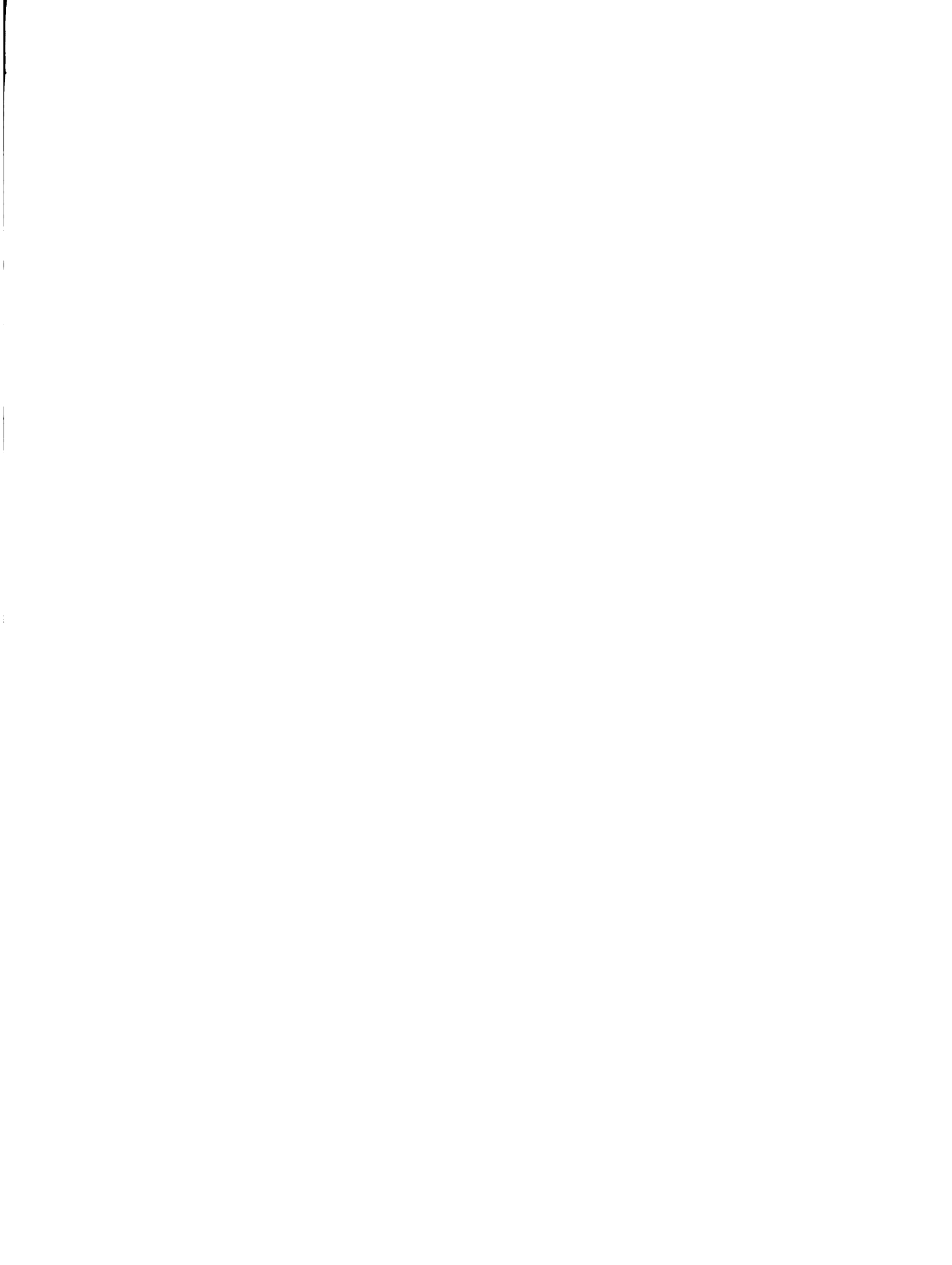
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# CONTENTS

<u>Section</u>	<u>Page</u>
<b>EXECUTIVE SUMMARY</b>	<b>vi</b>
<b>1.0 INTRODUCTION</b>	<b>1</b>
<b>2.0 METHODOLOGY</b>	<b>2</b>
<b>3.0 RESULTS</b>	<b>3</b>
3.1 Industry Profile	3
3.2 Level of Education	6
3.3 Range of Products	7
3.3.1 Juices/nectars/syrups/drinks	8
3.3.2 Jams/jellies/marmalades	9
3.3.3 Pulps/concentrates/fruits in syrup	9
3.3.4 Ice-creams/yogurts	9
3.3.5 Candied/dried fruits	10
3.3.6 Pickles and sauces	10
3.3.7 Wines	10
3.3.8 Other products	10
3.4 Major Markets	12
3.5 Raw Material	12
3.6 Processing Technology	25





## Contents Cont'd

	<u>Section</u>	<u>Page</u>
3.7	Sales (1993)	16
3.8	Waste Material Utilization	17
3.9	Packaging Material	17
3.10	Environmental Factors Limiting Performance	17
3.11	Technical Assistance Needed	18
3.12	Laboratory Capability	18
3.13	Research Facilities	19
4.0	<b>SUMMARY AND CONCLUSIONS</b>	19
5.0	<b>BIBLIOGRAPHY</b>	24
Appendix:	List of fruit processing enterprises and Laboratories facilities which participated in the survey	25



## **LIST OF TABLES**

		<b><u>Page</u></b>
1.	Summary of production volumes of tropical fruit products for the Caribbean region - 1993	4
2.	Summary of production volumes of tropical fruit products for 1993	7
3.	Levels of fresh fruit used by agroprocessors in English and Dutch-speaking Caribbean countries	11
4.	Area planted with tropical fruits in the English and Dutch-speaking Caribbean countries	13
5.	Summary of problems, solutions, and proposed activities based on results of Phase 1: Transformation of Tropical Fruits for the Caribbean	22

## **LIST OF FIGURES**

		<b><u>Page</u></b>
1.	Level of operation of fruit processing enterprises	5
2.	Level of education of personnel in fruit processing enterprises	7
3.	Range of products Produced in the various territories.	8



## ACRONYMS AND ABBREVIATIONS

AOAC	Association of Official Analytical Chemists
CARDI	Caribbean Agricultural Research and Development Institute
CARIRI	Caribbean Industrial Research Institute (Trinidad and Tobago)
CAST	College of Applied Science and Technology - Jamaica
CIRAD-FLHOR	Centre de Coopération Internationale en Recherche Agronomique pour le Développement - Département des Productions Fruitières et Horticoles (Montpellier, France)
CRITT	Centre Régional d'Innovations et de Transfert de Technologies (Guadeloupe)
EC\$	East Caribbean currency=US\$2.65 (May 1994)
EU	European Union
ENSIA-SIARC	Ecole Nationale Supérieure des Industries Agro-alimentaires - Section Industries Agro-alimentaires des Régions Chaudes (Montpellier, France)
FIC	French Interministerial Fund for the Caribbean
IAST	Institute of Applied Science and Technology (Guyana)
IICA	Inter-American Institute for Cooperation on Agriculture
ISU	International System of Units
MNIB	Marketing and National Importing Board (Grenada)
NAFTA	North American Free Trade Agreement
OECS	Organization of Eastern Caribbean States
PCL	Produce Chemist's Laboratory (Grenada)
PFU	Productive Farmers Union (Grenada)
R&D	Research and Development
SRC	Scientific Research Council - Jamaica
TSS	Total Soluble Solids
TTA	Total Titratable Acidity
UHT	Ultra High Temperature
UWI	The University of the West Indies - Trinidad and Tobago



## **ACKNOWLEDGEMENT**

The survey of the fruit processing industries in the English and Dutch-speaking Caribbean was part of an overall survey of the entire Caribbean, including the French West Indies, the Dominican Republic and Cuba.

This corresponded to Phase I of the project "Transformation of Tropical Fruits for the Caribbean" which is a component of the IICA - Government of French Regional Project: "Supporting the Development of Tropical Fruits in the Caribbean".

Special thanks to the French Inter-ministerial Fund for the Caribbean (FIC) and the French Ministry of Foreign Affairs (MAE) for their critical financial and technical contribution to the realisation of this survey.

Special thanks also to the team of consultants who visited the different countries and to Mrs. Judith Ann Francis, the CARIRI member of staff, who was in charge of supervising their activities collating and analysing the results.

Most of all, we would like to thank all the enterprises which participated in the survey, as well as their close collaborators, in the local ministries, cooperation agencies and specialised laboratories. The survey could not have achieved its objectives without their full support.

G rard Barbeau  
Fruit Crops Specialist  
IICA Office in Trinidad and Tobago





## EXECUTIVE SUMMARY

CARIRI was contracted by the Inter-American Institute for Cooperation on Agriculture (IICA) to coordinate the conduct of a survey of the fruit processing industry in the English and Dutch-speaking Caribbean countries. This formed part of Phase I of the project *Transformation of Tropical Fruits for the Caribbean* which was funded by the French Government through the French Inter-ministerial Fund for the Caribbean (FIC).

One hundred and forty-nine fruit processing enterprises and 11 analytical laboratories were surveyed by a team of professionals identified by CARIRI, CIRAD-FHLOR and IICA.

The survey was conducted using prescribed questionnaires during the period May to June 1994 in Barbados, Guyana, Jamaica, the Organization of Eastern Caribbean States (Antigua and Barbuda, Dominica, Grenada, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines), Suriname and Trinidad and Tobago. Consultants visited the organizations and enterprises in each territory.

The survey results indicate that fruit processors utilize a variety of fruits, traditional and 'exotics', to prepare juices/nectars/drinks, pulps/concentrates, jams/jellies/marmalades, ice creams/yoghurt, wine and other fermented products, candied fruits, pickles and sauces. These are marketed within the specific country, regionally and internationally. However, the majority of enterprises are cottage or small-scale operations with limited equipment capabilities and utilizing inappropriate processing technologies, hence greater impact cannot be made on the local or export markets due to poor product quality and limited shelf-life.

The lack of knowledge of the characteristics of the fruits and methods to maximize juice and pulp yield and preserve delicate fruit flavours and colours during processing adds to the problems facing the sector. To address these problems, Research and Development (R&D) institutions need to work closely with processors to develop new products and add value to fruit processing waste. Mechanisms must be put in place to assist regional R&D institutions to achieve these objectives.

The fruit processing enterprises in the Caribbean can be developed to:

- Maximize the use of seasonal raw material.
- Minimize wastage at the primary production level.
- Increase job opportunities.
- Save or earn foreign exchange.
- Enhance competitiveness in a liberalized market.



This survey conducted for Phase I of the project *Transformation of Tropical Fruits for the Caribbean* identifies the problems and the solutions needed to make the fruit processing sector a viable industry in the Caribbean.



# TRANSFORMATION OF TROPICAL FRUITS FOR THE CARIBBEAN

## 1.0 INTRODUCTION

The Caribbean Industrial Research Institute (CARIRI) was contracted by the office of the Inter-American Institute for Cooperation on Agriculture (IICA) in Trinidad and Tobago to coordinate the conduct of a survey on the fruit processing enterprises in the English and Dutch-speaking countries of the Caribbean. This exercise formed part of Phase I of the project *Transformation of Tropical Fruits for the Caribbean* which was funded by the French Government through the French Inter-ministerial Fund for the Caribbean (FIC). The countries identified were Barbados, Guyana, Jamaica, the Organization of Eastern Caribbean States (OECS; Antigua and Barbuda, Dominica, Grenada, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines), Suriname and Trinidad and Tobago.

The project was developed against the background that maximum utilization is not made of the wide range of tropical fruits by agroprocessors in the Caribbean Basin because of the following problems:

- Seasonal availability of the raw material.
- High wastage due to poor post-harvest handling and inadequate storage.
- Ad hoc production of non-traditional fruits which makes harvesting difficult.

The recent international developments with respect to world trade, namely the formation of the European Union (EU), the North American Free Trade Agreement (NAFTA), and United States/Latin America trade agreements in agriculture are expected to impact negatively on traditional fruit crops as farmers and fruit processors face competition in an expanded liberalized market.

The agro-industrial sector in the Caribbean must therefore shift focus to greater utilization of the non-traditional fruit crops, otherwise referred to as 'exotic' tropical fruits, to support/foster survival. Additionally, modernization of all aspects of the fruit processing industry (plant, equipment and processing technologies) and implementation of research and development programmes for new products are needed if fruit processors are to gain a competitive edge.

Several surveys have been conducted on the agro-industrial sector in the Caribbean Basin. The most recent of which was executed by Conformatica, S.A. de C. V. (Conformatica 1993). However, an in depth analysis of the fruit processing industry in the region has not



## TRANSFORMATION OF TROPICAL FRUITS FOR THE CARIBBEAN

previously been attempted. The survey of the fruit processing industry as funded by the French Government was therefore initiated to:

- Determine the depth and scope of the fruit processing sector.
- Facilitate the preparation and execution of a technology intervention phase.
- Upgrade the fruit processing industry in the Caribbean
- Maximize use of tropical fruit and minimize losses at the primary production stage.

A team of consultants was chosen by the various organizations involved; CARIRI, IICA and Centre de Cooperation Internationale en Recherche Agronomique pour le Développement-Département de Productions Fruitières et Horticoles (CIRAD-FHLOR). The various territories were divided as follows:

Ms Sophie Daulmerie (CIRAD-FHLOR)	-	OECS
Mr M S A Feroze (IICA)	-	Guyana
Mr Haroon Mohammed (CARIRI)	-	Trinidad
Dr Hanny Van de Lande (IICA)	-	Suriname
Ms Rhonda Wilson (CARIRI)	-	Barbados and Jamaica

Each consultant was allotted one month to collect the data. Ms Judith Ann Francis, CARIRI, was responsible for coordinating the project, collating and analysing the results and preparing the report.

### 2.0

## METHODOLOGY

A list of fruit processing plants and laboratory facilities in each territory was prepared in keeping with the mandate to target the major industries, 20% of the cottage industries and all laboratory support services. Letters were sent to each Organization inviting participation and telephone contacts were subsequently made to confirm agreement in the conduct of the survey.

Survey questionnaires were developed and either dispatched to the Organization prior to the consultant's visit or the consultant visited and conducted an on-the-spot interview. In the instances where data were not forthcoming from processors, published reports were used to facilitate completeness.





Data sought from industries included information on: types of products, raw material usage, production and sales volumes for 1992 and 1993, market niche, employment levels and educational background of employees, levels of processing technology and types of equipment used, quality control tests performed, methods of treatment of waste material, types of packaging material used, environmental factors affecting performance and future projections. Laboratory questionnaires were developed to obtain data on types of tests performed, equipment age and functionality, certification capabilities, factors limiting performance and future projections.

### 3.0 RESULTS

The majority of fruit processors who agreed to participate in the survey completed the questionnaires. Data were obtained for 149 processing plants using survey questionnaires and published reports. Although the survey initially targeted 20% of the cottage enterprises, the OECS consultant surveyed the majority of these enterprises in the islands. Some of the larger enterprises refused to provide data on quantities of raw material and production and sales volumes for the period under review as they considered the information to be confidential. Consultants also experienced problems obtaining data from some cottage and small industries in Trinidad, Guyana and Suriname as many operate on an informal basis and are not registered with the legal authorities thereby avoiding the tax net. Additionally, many cottage enterprises did not keep detailed production records and were unable to provide some of the necessary statistical information. Most processors only provided data for 1993.

The results for each country are summarized in Table 1. Data on laboratory facilities are given in the text.

The list of organizations which were visited is given in Appendix (1).

A discussion summary of the results follows.

### 3.1 Industry Profile

Fruit processing enterprises in the countries under review operate at various levels. They can be categorized as cottage, small, medium or large enterprises based on total assets, equipment capability, production volumes and size of plant.



# TRANSFORMATION OF TROPICAL FRUITS FOR THE CARIBBEAN

Table 1

Summary of production volumes of tropical fruit products for the Caribbean region - 1993

Country	Level of enterprise				Products (Kg or L)							
	C	S	M	L	Jams/jellies/ marmalades	Pulp, fruit concs/ fruits in syrup	Juices/ nectars/ drinks	Ice- cream/ yoghurt	Wine & other fermented products	Candied fruit/fruit cheeses etc.	Pickles & sauces	
Antigua & Barbuda	3	-	1	-	2,135	-	-	13,780	✓	-	-	
Barbados	-	-	3	1	✓	-	*2,300,00	127,841	-	-	-	
Dominica	5	-	3	1	3,103	59,876	*675	1,052	1,242,540	10,500	4,536	
Grenada	8	-	4	-	16,131	-	33,680	115,020	1,875	1,360	1,066	
Guyana	3	4	4	1	312,633	30,000	669,339	390,000	-	33,757	-	
Jamaica	-	-	1	5	*411,954	3,276,000	*1,030,320	-	-	2,273	-	
St Kitts & Nevis	9	-	1	-	2,924	-	227,880	702,000	-	-	90	
St Lucia	1	4	3	-	25,855	-	358,668	9,000	-	1,800	4,082	
St Vincent & the Grenadines	4	3	2	1	3,600	-	645,696	12,300	135,000	1,179	265	
Suriname	1	2	1	2	✓	45,600	✓	-	8,947	2,500	57,000	
Trinidad & Tobago	48	2	3	3	✓	*97,200	*840,000	✓	135,000	160,000	260,000	

✓ Significant production/data not provided  
 \* Under-reported  
 - Not manufactured

C Cottage  
 S Small  
 M Medium  
 L Large



## TRANSFORMATION OF TROPICAL FRUITS FOR THE CARIBBEAN

- **Cottage Industries**

Small units, usually home-based, employing approximately two to ten persons, using mainly domestic equipment and with total assets of less than US\$20,000.

- **Small industries**

Small factories, employing less than ten persons, operating with some pieces of semi-commercial equipment and with total assets of less than US\$100,000.

- **Medium industries**

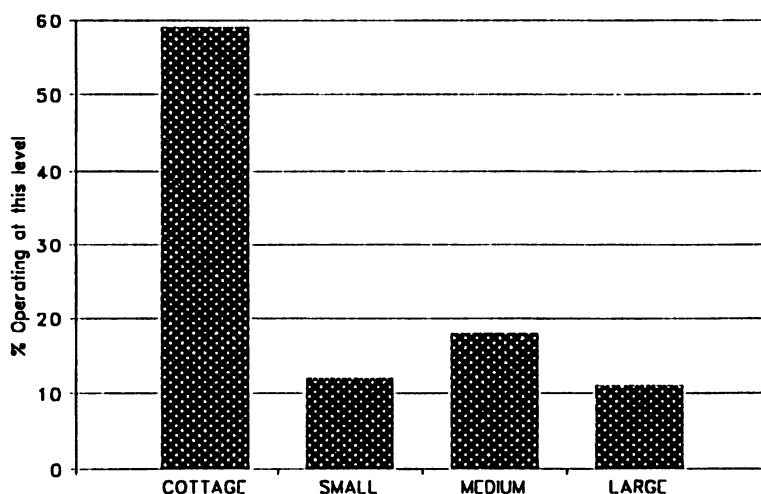
Small to medium-sized plants, employing ten or more persons, operating on a semi-commercial to commercial basis, with total assets of less than US\$1,000,000.

- **Large industries**

Large facilities, employing more than 100 persons, operating with commercial equipment on a semi-automatic to automatic basis with total assets exceeding US\$1,000,000 .

The number of enterprises existing in the various categories is shown in Figure 1.

This indicates that the majority of fruit processing enterprise operate at the cottage level.



**Figure 1** Level of operation of fruit processing enterprises



## TRANSFORMATION OF TROPICAL FRUITS FOR THE CARIBBEAN

However when the data were disaggregated the following were noted:

- Of the cottage enterprises 58.5% are concentrated in Trinidad and Tobago and 34.5% are distributed among the islands of the OECS.
- The majority 75% of the large fruit processing enterprises is located in Barbados, Guyana, Jamaica, Suriname and Trinidad and Tobago and the remaining 25% is located in the OECS, Dominica, St Kitts and St Vincent and the Grenadines.
- Medium and large enterprises predominance in the larger countries except for Trinidad and Tobago. However in the OECS countries, cottage and small enterprises comprise the bulk 68.5% of the fruit processing sector. There are some small enterprises located in Jamaica and Trinidad and Tobago which did not participate in the survey.

Site visits revealed that the majority of cottage, small and medium-scale enterprises in all countries operate under insanitary conditions. Additionally many of these plants are not well equipped. The larger enterprises are generally modern processing units which implement and adhere to accepted codes of hygiene and sanitation. The major limitation facing these larger facilities and some medium-sized plants is under-utilization of available plant capacity.

### 3.2 Level of education

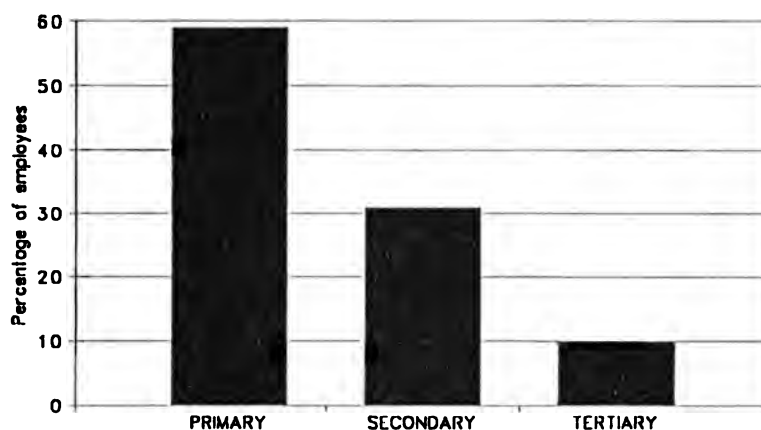
There were 2754 persons employed by the enterprises surveyed. The majority of persons working in the fruit processing industry achieved only primary school education (Figure 2).

Most of the larger industries employ persons with tertiary level qualifications in the areas of production and quality control. Many of the cottage processors indicated that there was a need for exposure to training in food processing. Consultants also noted that the majority of processors at the small and medium-scale levels had no formal training in food processing and were processing by trial and error.





## TRANSFORMATION OF TROPICAL FRUITS FOR THE CARIBBEAN



**Figure 2** Level of education of personnel employed in fruit processing enterprises

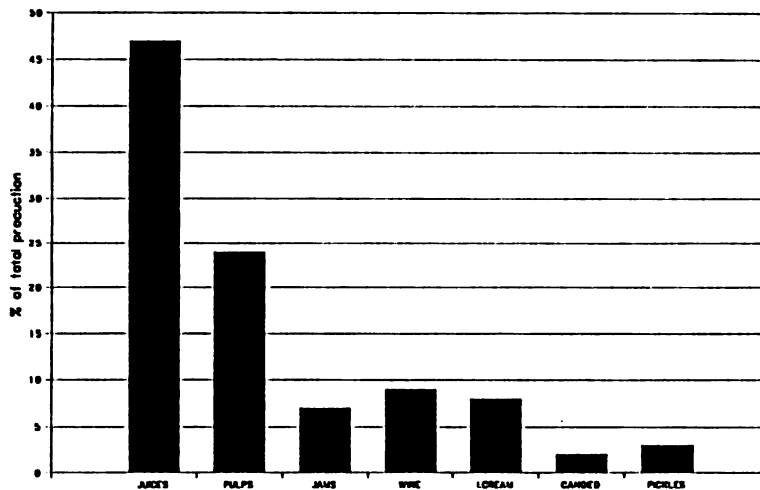
### 3.3 Range of products

The major products prepared from tropical fruits in the English and Dutch-speaking Caribbean countries are given in Table 2 and are reflected in Figure 3. The larger territories produced 95% of the volume of fruit-based products reported while the OECS countries accounted for only 5%. The most significant activity is in the manufacture of beverages (juices, nectars and syrups).

**Table 2** Summary of production volumes of tropical fruit products for 1993

Products prepared	Quantity
Juices/nectars/syrups/drinks	>7 million litres
Pulps/fruit concentrates/fruits in syrup	>3.5 million kg
Jams/jellies/marmalades	>1 million kg
Wine and other fermented products	>1.4 million kg
Ice-cream/yoghurt	1.3 million kg
Candied/dried fruit	213,500 kg
Pickles and sauces	>300,000 kg





**Figure 3** % of total production for each product category

Further analysis of the data showed that the picture for the OECS is different to that observed for the rest of the region. Beverages, wines and other fermented products and ice-creams and yoghurts accounted for 96% of the total OECS production while jams represented only 1.5%. Each product category is discussed separately.

### 3.3.1 *Juices/nectars/syrups/drinks*

A variety of tropical fruit beverages is produced in the Caribbean region. They are either sold as prepackaged ready-to-drink beverages (juices, nectars), or as syrups (squashes or cordials) for the further dilution by the consumer.

The major beverage processing facilities are the citrus processing plants located in Jamaica and Trinidad and Tobago, along with U H T processing facilities in Barbados, Jamaica, Trinidad and Tobago, Suriname, St Kitts and Nevis, Dominica and St Vincent and the Grenadines. The bottling plant in St Kitts produces a carbonated citrus beverage under licence from Jamaica. Many of the large facilities refused to give data on production volumes.

Some small and medium-scale enterprises produce a range of bottled fruit syrups (of varying fruit content) which are sometimes labelled concentrates or cordials. These are located in Dominica, St Lucia, St Vincent and The Grenadines, Jamaica, Suriname and Trinidad and Tobago. Three medium-sized enterprises located in Barbados, Guyana and



## TRANSFORMATION OF TROPICAL FRUITS FOR THE CARIBBEAN

Trinidad and Tobago also produce a range of canned fruit juices and nectars. Some cottage and small-scale enterprises located in Dominica, Grenada, Guyana and Suriname produce chilled fruit juices (with and without sugar) and nectars which are packaged in plastic bags or containers for over-the-counter sales or distribution to supermarkets, hotels and restaurants.

### 3.3.2 *Jams/jellies/marmalades*

Data were not obtained on volumes of jams produced in Barbados or Trinidad and Tobago, however, it is expected that production is significant (greater than 500,000 kg). Information provided by one Surinamese processor was eliminated from the results. The total volume of jams produced for 1993 as obtained from the survey approximated 1 million kg (1,000 tonnes) of which the OECS accounted for approximately 5.5%. In the OECS, 67% of the cottage industries are involved in jam processing and they accounted for 21% of the total volume of jam manufactured, the additional 79% was produced by two medium-sized enterprises, one located in Grenada and the other in St Lucia.

### 3.3.3 *Pulps/concentrates/fruits in Syrup*

Except for citrus concentrates, negligible quantities of fruit pulps, concentrates and fruits in syrup are produced in the region. The citrus processing plants in Jamaica accounted for 94% of the concentrates produced. Two facilities in Trinidad and Tobago produce fruit pulps (tamarind, passion fruit, guava and mango) and another plant produces sorrel concentrate on a limited scale. One medium-sized plant in Dominica and another in Guyana produce single strength passion fruit and carambola juices respectively for sale to beverage plant in other Caribbean territories. Canned pineapple slices in syrup are produced by facilities in Guyana and Jamaica.

### 3.3.4 *Ice-cream/yogurts*

Several medium-sized facilities manufacture ice-cream products using a range of tropical fruits; coconut, soursop and guava being the most popular flavours reported. Data were not obtained from one of the newest ice-cream plants located in Trinidad and Tobago which has publicly indicated its intention to attempt to penetrate the export markets with its range of tropical fruit ice-creams. Two medium-sized facilities in Guyana and St Kitts



accounted for 79% of the volume of ice-cream produced by the industries surveyed while another facility in Grenada produced 9%.

### 3.3.5 *Candied/dried fruits*

Data on plantain chip production in Dominica were included in this product category. Candied/dried fruit production in the region is minimal. The highest volumes were produced by one processor in Trinidad and Tobago (75%) and another in Guyana (15.5%). The OECS produced only 6.5% of the total volume reported. The main fruits candied are papaya in Trinidad and Tobago and carambola in Guyana. Dried jackfruit is prepared and sold in Jamaica.

There is a large facility in Guyana which produces a range of dried fruit targeted to the North American health food market. The plant was visited but the management did not participate in the survey. They indicated that there was a lack of financial sensitivity to their needs and this was hampering their efforts. The College of Applied Science and Technology (CAST) in Jamaica has initiated a project to produce dried fruit. Several cottage level units are participating in this project and the products are packaged and sold under a common label.

### 3.3.6 *Pickles and sauces*

The majority of cottage enterprises in Trinidad and Tobago and the OECS accounted for 80% of the total volume of fruit pickles and sauces. Data on pepper sauce production collected in the OECS were eliminated from the results. The pickles are mainly Indian style oil-based mango pickles and fruit chutneys and sauces.

Two processing plants in Suriname produce a range of bottled pickles using a variety of fruits.

### 3.3.7 *Wines*

The production of tropical fruit wines and other alcohol-based fruit beverages is limited to cottage and small-scale enterprises in Trinidad and Tobago, Dominica, St Lucia and St Vincent and the Grenadines. A variety of fruits is used.





TRANSFORMATION OF TROPICAL FRUITS FOR THE CARIBBEAN

Table 3

Levels of Fresh Fruits used by agroprocessors in English and Dutch-speaking Caribbean Countries

Country	Banana/ plantain	Caram- bola	Citrus	Guava	Mango	Passion Fruit	Papaya	Pineapple	Plum	Sorrel	Sour- sop	Tamarind	West Indian cherry	Others: sapodilla Golden apple/ bilimbi
Antigua & Barbuda	+	-	-	+	+	+	+	-	-	-	+	+	+	+
Barbados	-	-	+	+	-	-	-	-	-	-	-	+	+	+
Dominica	+++	-	++	+	-	++++	-	-	-	-	+	+	-	-
Grenada	+	-	+	+	+	+	+			+	+			+
Guyana	+	+++	+	+	+	+	+	+++	+	-	-	+	+	-
Jamaica	-	-	++++	+++	++++	-	++++	+++	-	-	++	+	-	
St Kitts & Nevis	-	-	+	+	-	-	+	+	-	-	+	+	-	+
St Lucia	+	-	+	+	-	-	+	+	-	-	+	+	-	+
St Vincent	+	+	+	+	+	+	-	+	-	+	+	+	+	
Suriname	-	+	+++	-	+	+++	++	+	+	-	+	-	+++	
Trinidad & Tobago	-	-	++++	++	+++	+	+++	++	+	++	-	+	-	+

+ <50,000 kg fruits / ++ 50,000 - 100,000 kg fruits / +++ 100,000 - 500,000 kg fruits / ++++ >500,000 kg fruits



## 3.3.8 *Other products*

Two products which are of commercial significance because they are produced mainly for export are canned heart-of-palm in Guyana and canned ackee in Jamaica. The volume of canned heart-of-palm produced for 1993 by one large facility in Guyana was 1.1 million kg. Canned ackee is produced by small and medium-sized enterprises in Jamaica. Data on 1993 ackee production volume were obtained from two processing plants and this totalled approximately 500,000 kg. Processors in both countries indicated that problems are experienced sourcing raw material. Export demand for the products is high and processors project growth in export sales if raw material supply can be improved.

## 3.4 **Major Markets**

Seventy percent of the industries sell all their products on the local market while 30% export between 50 to 100% of their annual production. Major markets include other CARICOM countries, Canada, the United States of America (USA) and the European Union (EU) - France, Belgium, the Netherlands and the UK. Products exported include fruit pulps, candied fruits, canned heart-of-palm, citrus oils and other citrus products, jams and jellies and canned pineapple.

## 3.5 **Raw Material**

The data obtained on raw material utilization were very extensive for some countries and limited for others. The variety and quantum of fruits used by the various territories are reflected in Table 3.

In some cases extrapolations were made based on data provided for finished product volumes using the following assumptions.

- Fruit content in jams and jellies was approximately 45-50%.
- Juice in fruit drinks and ice-creams was approximately 10%.

It was found that:

- Fruit processors utilize local raw materials as follows:  
Guyana and Suriname - 100%



TRANSFORMATION OF TROPICAL FRUITS FOR THE CARIBBEAN

Table 4

Area Planted with Tropical Fruits in the English and Dutch-Speaking Caribbean Countries

Country	Caram-bola		Citrus		Guava		Mango		Passion fruit		Papaya		Pineapple		Pomme cythere		Soursop		West Indian cherry		
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
Antigua & Barbuda	-	-	8	-	2	-	12	*	-	-	2	-	-	-	40	-	-	-	-	-	-
Barbados	2	-	12	-	28	38	47	133	-	-	1	-	2	-	1	21	2	-	-	62	38
Dominica	-	-	2020	-	-	10	124	*	120	-	-	-	8	-	-	-	2	5	-	-	-
Grenada	-	-	-	60	-	25	10	60	2	-	-	-	-	-	-	20	-	25	-	-	5
Guyana	12	2450	1620	*	113	*	-	*	35	-	-	*	600	*	-	5	2	-	-	61	-
Jamaica	-	-	8100	*	6	180	526	*	-	-	420	-	-	-	-	-	2	20	-	-	-
St Kitts & Nevis	-	-	-	10	1	-	-	20	-	-	1	-	1	-	-	*	-	-	-	-	-
St Lucia	-	-	-	680	-	-	-	545	-	-	-	-	30	-	-	-	-	*	-	-	-
St Vincent & the Grenadine	-	-	32	*	-	-	18	22	-	-	-	-	2	-	-	*	*	*	-	-	-
Suriname	*	*	2425	*	-	11	-	250	42	-	88	-	-	-	-	-	22	-	-	53	-
Trinidad & Tobago	5	-	6000	*	20	*	25	-	12	-	100	-	42	-	-	-	-	-	-	-	-

A: Hectares planted

B: Estimated areas with small plantations and isolated trees

\*: Important quantity of isolated trees



## TRANSFORMATION OF TROPICAL FRUITS FOR THE CARIBBEAN

- |                      |   |     |
|----------------------|---|-----|
| Jamaica and the OECS | - | 90% |
| Trinidad and Tobago  | - | 65% |
| Barbados             | - | 20% |
- All major beverage processing plants, except for the UHT plant in Suriname, rely on imported fruit concentrates for the production of juices and nectars. Some medium-scale processors supply larger industries with semi-processed fruit.
  - The majority of cottage, small and medium-sized enterprises utilize fresh fruits.
  - A rough estimate of the total volume of fruit processed by manufacturers surveyed was 6,700 tonnes. The main fruits processed in the region in descending order of significance are citrus (orange and grapefruit), mango, guava, papaya, pineapple, passion fruit, plantain and banana, soursop, tamarind, West Indian cherry, carambola and other minor fruits (sapodilla, golden apple, plums and bilimbi). When these data were further disaggregated, it was noted that the main fruits utilized for processing are specific to the country and directly related to the area under production (Table 4).
    - **Citrus** is of importance in Jamaica, Trinidad and Tobago and Suriname and, to a lesser extent, Dominica and the other islands.
    - **Mango** is of importance in Jamaica (beverages and jam processing) and Trinidad and Tobago (pickles mainly).
    - **Papaya** is of importance to Jamaica (beverages and jams), Trinidad and Tobago (candied fruit) and to a lesser extent Suriname (beverages).
    - **Pineapple** is of importance to Jamaica and Guyana (beverages and canned slices/chunks) and to a lesser extent Trinidad and Tobago.
    - **Passion fruit** is of major importance to Dominica, Guyana and Suriname (beverages, jams/jellies).
    - **Guava** is important to Jamaica, Trinidad and Tobago and the OECS.
    - **Carambola** is of importance in Guyana.





## TRANSFORMATION OF TROPICAL FRUITS FOR THE CARIBBEAN

- **West Indian cherry** is of importance in Guyana and Suriname
- **Plantain** is of importance in Dominica for the production of plantain chips.
- Other minor exotic fruits, (e.g. sapodilla, plum, mamey apple, golden apple) are of importance to cottage industries mainly in the OECS.
- Processors compete for raw material with fruit destined for the fresh fruit market. Some medium-sized processors stated that this resulted in them having to pay a high cost for the raw materials. However, this was not a problem with cottage enterprises which relied on supplies of raw material from backyards or farms under their direct control. Some processors in Guyana and Suriname also indicated that 10 to 20% of raw materials is obtained from their own farms. Additionally, there is no varietal selection with respect to fruits used for processing.

Seasonality, quantity and cost of fresh fruit were the most frequent responses given to the question of problems processors experience with fresh raw materials. Limited availability of storage facilities and cost of refrigerated space also hindered many processors from storing seasonal fruits. Processors also indicated a 1-15% annual loss in raw materials at the processing plant.

### 3.6 Processing Technology

The majority of enterprises (75%) mainly cottage and small-scale enterprises indicated that they experienced problems with the quality of their finished products. Problems included microbial spoilage in jams and syrups, colour and textural variations in jams and ice-creams, colour changes and separation in beverages on storage, failure to stabilize fruit flavours in all products, production of vinegar instead of wines and limited product shelf-life. Some of these problems were also noted by consultants on visual inspection or further evaluation of products. The lack of homogeneity, poor quality and limited shelf-life of finished products can be related to:

- Lack of and/or non-conformance to standards. Local, regional or international standards do not exist for many of the tropical fruit products prepared (e.g. some



## TRANSFORMATION OF TROPICAL FRUITS FOR THE CARIBBEAN

beverages are labelled juices or concentrates when they are not). Minimum fruit content for many products has not been established.

- Variances in processing methods used by cottage, small and medium-scale processors. Some processors indicated that they were aware that alternative processing technologies exist but cannot source the information to improve product quality.
- Failure of many cottage, small and medium-scale enterprises to utilize standard quantitative and qualitative tests and procedures and equipment for judging the end-point of products or monitoring critical control points during processing. Absence of simple quality control tools, e.g. thermometers and refractometers, was noted by consultants.

The majority of the large enterprises either have in-house testing facilities or utilize private or government laboratories.

In countries where the Bureau of Standards or Produce Chemist's Laboratory is effective, e.g. Jamaica and Dominica, consultants reported that the quality of the finished product is high.

- Use of inappropriate or lack of suitable equipment and/or processing under insanitary conditions. These factors apply mainly to cottage, small and medium-scale enterprises. Processors reported low juice yield or inability to increase juice yield as a major problem related to lack of suitable equipment.

Many of these enterprises expressed concern at their inability to source suitable equipment at affordable prices to maximize production and improve product quality.

### 3.7 Sales (1993)

Sixty-one firms provided data on total sales for 1993. The total value reported was approximately US\$42 million. Jamaica accounted for US\$29.4 million which represented data obtained from three large firms including the citrus processing plant. Five firms in Trinidad and Tobago, the citrus plant and two small and two medium-sized



facilities reported a total sales of US\$7.5 million. The OECS data represented total sales for 41 firms but this totalled a mere US\$3 million.

### 3.8 **Waste Material Utilization**

A minimum attempt is made by fruit processors to maximize use of waste material (skins, seeds) generated during fruit processing. The majority of processors dispose of the waste at garbage sites. The citrus processing plants in Jamaica and Trinidad and Tobago produce citrus meal from citrus waste.

### 3.9 **Packaging Material**

The majority of processors utilize glass or plastic for packaging finished goods. Metals, cans and aseptic packaging (Tetra Pak) are utilized by most of the large processing facilities. Processors indicated that the cost of packaging material and the limited choice available are the major problems. Some processors in Suriname indicated an interest in changing to twist-off caps for glass jars but efforts have been unsuccessful. Some cottage industries re-use glass jars and encounter spoilage problems.

### 3.10 **Environmental Factors Limiting Performance**

The following is a breakdown of how processors rated the factors limiting performance:

Financial	-	38%
Marketing	-	27%
Technical	-	20%
Political	-	15%

It would appear that the most critical problem which limits the performance of regional fruit processors is limited access to financing and lack of financial support for the sector. Other problems mentioned included unreliable supply of electricity and water, high cost and limited availability of additives and failure to retain staff after having trained them. Some processors indicated that their future plans hinged on availability of finances. If financing was more accessible, processors would invest in plant and machinery to upgrade processing capabilities.



### 3.11 Technical Assistance Needed

Processors indicated that their major needs are

- Training to improve existing operations, advice on machinery suitable for the processing of tropical fruit and size of operations
- Exposure to appropriate processing technologies (production of juices, wine, dried fruit)
- Assistance with marketing
- Training in quality control systems
- Information on appropriate use of additives
- Information on methods of stabilizing fruit flavours
- Methods for increasing yield of fruit pulps.

Some large firms indicated that research and development activities were needed to support the sector and that this was critical.

### 3.12 Laboratory Capability

Eleven laboratories participated in the survey. The assessment of the laboratory capabilities revealed that facilities exist within the region to support the fruit processing industries. However, the extent of food product testing is dependent on available equipment and financing. The more developed and best equipped facilities are located in Jamaica and Trinidad and Tobago. Major pieces of equipment in all countries are outdated or in need of repairs and this limits laboratory capabilities. Barbados, Guyana and Suriname are in need of funding to upgrade laboratory facilities to meet the demands of the food processing sector. The country most in need of urgent assistance is Guyana.

The Produce Chemist's Laboratories which exist in the OECS, all seem to have a different focus. Some offer product development services, others only chemical or microbiological testing services, and yet others a combination of these services-product development, chemical and microbiological. The Produce Chemist's Laboratory, Grenada is also producing products for sale to the general public under the activity, 'test marketing'.

Generally, all laboratories are interested in obtaining international accreditation/





## TRANSFORMATION OF TROPICAL FRUITS FOR THE CARIBBEAN

certification capabilities but require funding. Presently the Bureau of Standards in Jamaica and the Food and Drugs Division of the Ministry of Health in Trinidad and Tobago certify food products for sale on the local and export markets.

### 3.13 Research Facilities

Research and training facilities exist in Guyana (Institute of Applied Science and Technology; IAST), Jamaica (Scientific Research Council; SRC), Trinidad and Tobago (CARIRI) and at their respective university campuses to support the development of the fruit processing sector. However, these facilities have received reduced subventions from governments and as a result, unless donor funding is available, negligible research activities will be undertaken to develop or adapt processing technologies for local fruits to enhance the sector. IAST and SRC personnel were not available to discuss present and future plans with consultants despite confirmed appointments. Discussions were held with personnel at the University of Guyana who indicated that the training facility for food processing would be upgraded with funds provided by the government.

## 4.0 SUMMARY AND CONCLUSIONS

A wide range of tropical fruits is grown in the English and Dutch-speaking Caribbean countries. Results of this survey indicate that these are converted into a range of fruit products for consumption in the Caribbean Basin and for export. However, it is only a few of the medium and large enterprises in some countries that have been able to penetrate export markets.

Fruit processors are inhibited by a number of factors which limit their capability to maximize the fruits grown and to be competitive on the local and export markets. The major limiting factors are finances, inappropriate processing technologies, inadequate training and inadequate infrastructural support.

The results of the survey conducted on the fruit processing enterprises suggest that there is immediate need for:

- Training of all cottage, small and medium-scale processors to upgrade and standardize processing technologies for the range of products prepared at present. Priority should be given to the manufacture of beverages, jams and ice-



## TRANSFORMATION OF TROPICAL FRUITS FOR THE CARIBBEAN

creams in the first instance. Training in quality control and plant sanitation is also necessary. Training should be targeted to existing processors.

- Existing information on appropriate equipment for improving the production of existing products and suitable varieties for processing to be made available to processors.
- Development/sourcing of small-scale equipment to improve existing processing capabilities of cottage, small and medium-sized enterprises.
- The conduct of research and development projects to maximize the use of waste material (value added by-products) and to identify a range of new products using 'exotic' tropical fruit. Emphasis should be placed on developing the processing potential of one or two main fruit crops in each country. This must be supported by identification and production of high-yielding, disease-resistant varieties specifically for the fruit processing industry.
- Upgrading of the analytical capabilities of existing laboratory facilities and personnel within the region to assist in monitoring and ensuring that processing plants meet accepted hygiene requirements and ensure that high-quality products are prepared. This is essential to meeting export requirements.
- Developing standards for fruit products prepared in the Caribbean. Finalization of draft standards already prepared by the CARICOM Secretariat (Caribbean Export Development Project) should be pursued.
- Sensitizing the banking community to the needs of the fruit processing sector.
- Developing the agricultural sector simultaneously to increase efficiency and reduce costs. Confidence between farmers and processors needs to be re-established. Establishment of fruit orchards needs to be encouraged for non-traditional fruits.
- Expansion of citrus, canned heart-of-palm and canned ackee exports should be



## TRANSFORMATION OF TROPICAL FRUITS FOR THE CARIBBEAN

supported and encouraged given their export earning capabilities. At present no organized systems for growing or harvesting ackees or heart-of-palm exist.

Representatives from CARIRI, Centre Regional d'Innovation et de Transfert de Technologie Biotechnologie et Agro-Industrie de la Caraibe (CRITT) and IICA met and discussed the results of Phase I of the project. The medium and long-term strategies for improving the fruit processing capabilities within the Caribbean Basin were developed at that meeting and appear in Table 5.

In conclusion, maximizing the use of 'exotic' tropical fruits and improving the processing technology and production capability of agroprocessors in the Caribbean Basin offer the only possible solutions to:

- Minimizing losses at the primary production level.
- Improving job opportunities.
- Saving/earning foreign exchange.
- Enhancing competitiveness in a liberalized market.
- Ensuring viability of the fruit processing subsector.



# TRANSFORMATION OF TROPICAL FRUITS FOR THE CARIBBEAN

**Table 5**                      **Summary of Problems, Solutions and Proposed Activities**  
**based on results of Phase I**  
**Transformation of Tropical Fruits for the Caribbean**

Problems	Possible solutions	Activities to be developed within the project
<p><b>1. Limited Access to Information on:</b></p> <ul style="list-style-type: none"> <li>- New processing varieties</li> <li>- Supply of raw materials</li> <li>- Processing techniques</li> <li>- Standards for Fresh, Semi-processed &amp; Finished products</li> <li>- Markets, Prices</li> </ul>	<ul style="list-style-type: none"> <li>- Improve relationships between R/D in the Caribbean</li> <li>- Identification of Research capabilities of each organisation</li> <li>- Transfer technical information to processors</li> </ul>	<ul style="list-style-type: none"> <li>- Networking between R/D institutions</li> <li>- Dissemination of technical documents/Newsletters</li> <li>- National/Regional meetings and events</li> </ul>
<p><b>2. Supply of Raw Materials</b></p> <ul style="list-style-type: none"> <li>- Seasonality</li> <li>- Cost, quantity, quality</li> <li>- Reliability of suppliers</li> <li>- Competition between fresh fruit trade and processing</li> </ul>	<ul style="list-style-type: none"> <li>- Better selection of varieties for processing</li> <li>- Adequate cold storage facilities</li> <li>- Development of intermediate products</li> <li>- Encourage development of multipurpose processing facilities</li> <li>- Maximize complementarity between countries</li> </ul>	<ul style="list-style-type: none"> <li>- Identification of suitable varieties for processing</li> <li>- Training in postharvest handling at all levels</li> <li>- Post harvest studies</li> <li>- Access funding for cold storage facilities</li> </ul>
<p><b>3. Processing Technologies</b></p> <ul style="list-style-type: none"> <li>- Limited shelf life of products</li> <li>- Inadequate/obsolete equipment</li> <li>- Poor plant sanitation</li> <li>- High level of losses (fresh &amp; processed products)</li> <li>- Lack of Homogeneity of similar products (composition, flavour, texture, colour)</li> </ul>	<ul style="list-style-type: none"> <li>- Standardisation of processes</li> <li>- Introduction of suitable processes</li> <li>- Design/adaptation of small scale equipment</li> <li>- Maximize utilization of fruits</li> </ul>	<ul style="list-style-type: none"> <li>- Characterization of raw material</li> <li>- Foster collaboration between designers /producers of equipment in the region</li> <li>- Upgrading and expansion of pilot units</li> <li>- Training at all levels</li> <li>- Student attachments to research institutions and processors</li> <li>- Development of by-products</li> <li>- Technical assistance to enterprises</li> <li>- Dissemination of information</li> </ul>





# TRANSFORMATION OF TROPICAL FRUITS FOR THE CARIBBEAN

Problems	Possible solutions	Activities to be developed within the project
<p><b>4. Quality Control</b></p> <ul style="list-style-type: none"> <li>- Inappropriate use of additives</li> <li>- Limited testing for pesticide residues</li> <li>- Minimum conformity to standards/norms</li> <li>- Sporadic/inconsistent monitoring by government agencies</li> </ul>	<ul style="list-style-type: none"> <li>- Better selection of raw materials</li> <li>- Introduction of appropriate technology</li> <li>- Development of regional standards and conformance to international standards</li> </ul>	<ul style="list-style-type: none"> <li>- Cooperation between regional Bureau of Standards</li> <li>- Training of farmers, laboratory personnel</li> <li>- Identification of capabilities in the region for pesticide residue analysis</li> <li>- Upgrading of government produce chemist's laboratories</li> </ul>
<p><b>5. Difficulty to penetrate markets</b></p> <ul style="list-style-type: none"> <li>- Poor packaging/labelling</li> <li>- Identification of markets</li> <li>- Cost of packaging</li> <li>- Limited choice</li> </ul>	<ul style="list-style-type: none"> <li>- Development of regional standards</li> <li>- Harmonization of standards</li> <li>- Promotion of products in regional and extra-regional fairs</li> <li>- Market intelligence</li> </ul>	<ul style="list-style-type: none"> <li>- Dissemination of information</li> </ul>
<p><b>6. Limited access to funding</b></p> <ul style="list-style-type: none"> <li>- Unaffordability of foreign exchange</li> <li>- Limited access to financing for upgrading plant and equipment etc.</li> <li>- No export of finished goods credit</li> <li>- Unresponsiveness of banks/high interest rates</li> </ul>	<ul style="list-style-type: none"> <li>- Educate policy makers especially banking sector</li> <li>- Promote joint venture between foreign/regional/local farmers and industries</li> </ul>	<ul style="list-style-type: none"> <li>- Seminars</li> <li>- Newsletters</li> </ul>
<p><b>7. Limited Research/Development of New Products</b></p>	<ul style="list-style-type: none"> <li>- Conduct research of new products, flavours, colours, cosmetics.</li> </ul>	<ul style="list-style-type: none"> <li>i) Student attachment to Research Institutions/processors</li> <li>ii) Development and execution of collaborative research projects among regional research and development institutions</li> </ul>



## TRANSFORMATION OF TROPICAL FRUITS FOR THE CARIBBEAN

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**APPENDIX I**

**LIST OF FRUIT PROCESSING ENTERPRISES**

**AND LABORATORY FACILITIES**

**which participated in the**

**SURVEY OF THE FRUIT PROCESSING INDUSTRY**

**in the**

**ENGLISH AND DUTCH-SPEAKING CARIBBEAN COUNTRIES**

**PHASE I**

**TRANSFORMATION OF TROPICAL FRUITS FOR THE CARIBBEAN**



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