

IICA



Centro Interamericano de
Documentación e
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IICA — CIDA

**PROCEEDINGS OF A WORKSHOP ON
POST HARVEST HANDLING OF
HORTICULTURAL COMMODITIES FOR EXPORT**

**ST. AUGUSTINE, TRINIDAD
JUNE 25-27, 1990**

Central Marketing Agency (CMA)
The University of the West Indies (UWI)
The Ministry of Food Production & Marine Exploitation

PROGRAM IV: MARKETING AND AGROINDUSTRY

WHAT IS IICA?

The Inter-American Institute for Cooperation on Agriculture (IICA) is the specialized agency for agriculture of the Inter-American system. The Institute was founded on October 7, 1942 when the Council of directors of the Pan American Union approved the creation of the Inter-American Institute of Agricultural Sciences.

IICA was founded as an institution for agricultural research and graduate training in tropical agriculture. In response to changing needs in the hemisphere, the Institute gradually evolved into an agency for technical cooperation and institutional strengthening in the field of agriculture. These changes were officially recognized through the ratification of a new convention on December 8, 1980. The Institute's purposes under the new convention are to encourage, facilitate and support cooperation among the 31 Member States, so as to better promote agricultural development and rural well-being.

With its broader and more flexible mandate and a new structure to facilitate direct participation by the Member States in activities of the Inter-American Board of Agriculture and the Executive Committee, the Institute now has a geographic reach that allows it to respond to needs for technical cooperation in all of its Member States.

The contributions provided by the Member States and the ties IICA maintains with its twelve Permanent Observer Countries and numerous international organizations provide the Institute with channels to direct its human and financial resources in support of agricultural development throughout the Americas.

The 1987-1991 Medium Term Plan, the policy document that sets IICA's priorities, stresses the reactivation of the agricultural sector as the key to economic growth. In support of this policy, the Institute is placing special emphasis on the support and promotion of actions to modernize agricultural technology and strengthen the processes of regional and sub-regional integration.

In order to attain these goals, the Institute is concentrating its actions on the following five programs: Agricultural Policy Analysis and Planning; Technology Generation and Transfer; Organization and Management for Rural Development; Marketing and Agroindustry; and Animal Health and Plant Protection.

These fields of action reflect the needs and priorities established by the Member States and delimit the areas in which IICA concentrates its efforts and technical capacity. They are the focus of IICA's human and financial resource allocations and shape its relationship with other international organizations.

The Member States of IICA are: Antigua and Barbuda, Argentina, Barbados, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Dominica, the Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago, the United States of America, Uruguay and Venezuela.

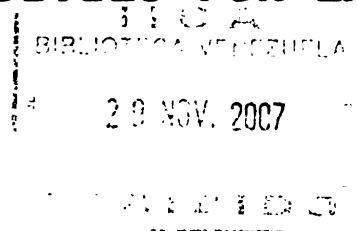
The Permanent Observer Countries of IICA are: Arab Republic of Egypt, Austria, Belgium, Federal Republic of Germany, France, Israel, Italy, Japan, Netherlands, Portugal, Republic of Korea and Spain.

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**AUDITORIUM, FACULTY OF ENGINEERING
THE UNIVERSITY OF THE WEST INDIES
ST. AUGUSTINE
JUNE 25-27, 1990**

Edited by

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The Export Development Corporation
Food Scene Supplement of the Agricultural Development Bank
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The Information Division of the Prime Minister's Office
The Trinidad and Tobago Television
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FOREWORD

The Central Marketing Agency (CMA), The Inter-American Institute for Cooperation on Agriculture (IICA), The University of the West Indies (UWI) and the Ministry of Food Production and Marine Exploitation (MFPME), as part of the thrust to increase agricultural exports, hosted a Workshop on Post Harvest Handling of Horticultural Commodities for Export, aimed at sensitizing the major actors involved in the export of agricultural produce to the techniques available for improving post harvest management and the market opportunities for fresh horticultural commodities (fruits, vegetables, roots and cut flowers).

Recently Trinidad and Tobago has experienced a high rate of growth in the export of fresh horticultural commodities, with an increase in volume of exports of three hundred percent (300%) over the last four years. BWIA has reported shipment increases from three hundred tonnes (300) in 1986 to fifteen hundred tonnes (1500) in 1989. These increases place heavy demands on the areas of port infrastructure, adequate packaging materials and the operation of packing houses, as well as quarantine facilities and cold storage, will become important.

This country has the capacity to increase the production of horticultural commodities for export, but it is necessary to improve and strengthen the above areas to facilitate the process of production, handling and management of exports.

IICA's contribution to this initiative was made under the framework of the Technical Cooperation Project with the Ministry of Food Production and Marine Exploitation, "Technical Support to Improve Food Marketing Systems in Trinidad and Tobago" with the Central Marketing Agency (CMA) as the counterpart institution.

The objectives of this Workshop were:

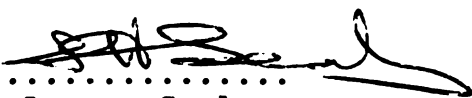
1. To transfer technology to exporters of horticultural products from Trinidad and Tobago in order to encourage the effective and efficient development of the export sector.
2. To analyze the main technological advances as applied to the business of exporting horticultural products.
3. To discuss marketing opportunities for selected commodities.
4. To discuss air and sea transport for horticultural products.


5. To discuss packaging materials being used in marketing horticultural products in international markets.
6. To discuss financing for export.
7. To discuss the administrative procedures required for the export of horticultural products.

The Workshop was attended by 160 persons mainly farmers, representatives of farmers' organizations and exporters. Agribusiness entrepreneurs from St. Vincent and Guyana also attended.

These proceedings comprise all papers presented and discussed during the Workshop. It is hoped that this information will prove useful to those entrepreneurs, farmers and experts interested in producing and exporting fresh vegetables, fruits and cut flowers.

The organizers take this opportunity to wish those persons involved as well as those about to be involved best wishes in their ventures.


.....
Dr. Lennox Sealy
General Manager
Central Marketing Agency


.....
Dr. Joan Wallace
IICA Representative
in Trinidad and Tobago

O P E N I N G S E S S I O N

OPENING REMARKS

by

DR. JOAN S. WALLACE

**INTER-AMERICAN INSTITUTE FOR COOPERATION ON AGRICULTURE (IICA)
REPRESENTATIVE IN TRINIDAD AND TOBAGO**

Honourable Minister Samaroo, Dr. Pollard, Dr. Sealy, Presenters and Participants, I am pleased to bring greetings from Dr. Martin E. Pineiro, Director General of the Inter-American Institute for Cooperation on Agriculture (IICA), and to also welcome you.

IICA is very glad to share with the Ministry of Food Production and Marine Exploitation and the Central Marketing Agency, the responsibility for organizing this Workshop on Post Harvest Handling of Horticultural Commodities for Export.

IICA is an International Organization composed of 31 Nations in this hemisphere. The Board consists of Ministers of Agriculture, so Dr. Brinsley Samaroo represents Trinidad and Tobago (T&T) on the Board. Our work is in five areas:

Agrarian Policy Analysis and Planning,
Technology Generation and Transfer,
Organization and Management for Rural Development,
Animal and Plant Health, and
Marketing and Agroindustry.

Through these program areas we work to facilitate the reactivation of agriculture in the Region. Our Plan of Joint Action for Agricultural Reactivation in the Caribbean (PLANLAC), has taken account of the plans of Caricom and other organizations and ties activities to a multinational base. The new plan for achieving self-sustained development sees the connection between agriculture and agro-industry, between production for the domestic market and production for export and between economic development and social progress. We, in IICA, feel that it is essential to develop a new outlook and take on the challenges of the present and future with optimism!

I have a personal interest in the subject. In my previous job at the USDA, I had world-wide responsibility as I travelled to various countries, I listened to agriculturists talk constantly about increased production and I would hear, sometimes in the same country, that 60% of their crops were lost in Post Harvest Handling. It seemed curious to me that there was so much concern about production and no concern about post harvest issues. I am grateful that here today we have concern for both.

Trinidad and Tobago has developed a strategy for improved exportation of diversified agricultural products through the good offices of the Ministry of Food Production and Marine Exploitation. Several institutions are working in this effort and a new understanding can be observed between private and public institutions. As a result of this, the private sector has responded rapidly in the last five years and the country has experienced a high rate of growth in the export of fresh horticultural commodities, with an increase in volume of exports of more than 300%. For instance, BWIA has reported shipment increases from 300 tonnes in 1986 to 1,500 tonnes in 1989. That's 500%.

According to a Report of the Committee on Product Standards to the Ministry on February 6, 1990, export of fresh produce increased in value from TT\$1.45 million in 1986 to TT\$3.9 million in 1988. For the first semester of 1989, exports were valued at TT\$2.1 million. That's fantastic.

The export destinations number approximately 30 countries. The main importing countries are U.S.A., Canada, U.K., The Netherlands and Caribbean countries with more than 70% of the exports.

In exporting fresh commodities, it is important to realize that international trade in fresh tropical produce is highly competitive with a number of aggressive participants attempting to secure a maximum financial share of the market. The Report states:

"Trinidad and Tobago's thrust into this market is in its infancy and consequently requires significant support based on meticulous planning, effective decision-making and careful attention. Further the degree of success achieved by Trinidad and Tobago in this effort will be determined by the ability of its exporters to supply reliably to importing countries, quality produce in dependable quantity and condition at competitive prices and conforming consistently to the specifications and standards characteristic of such countries".

If we are not reliable suppliers we won't have customers long.

The increasing exports will place heavy demands on areas of: Port Infrastructure (air and sea), Transport (air and sea) and Packaging and Package Supply, Packing Houses (Equipment, Machinery, Know How), Farmers' Organizations, Marketing Companies, Quarantine Control and Security.

Exportation of fresh agricultural commodities from the point of view of private enterprise is by definition, agro-industrial activity. That is to say, that it is a complex of numerous activities dealing with the production of raw material, the post

harvest handling of the fresh products for market, continuous market analysis and management.

IICA understands very well that the task of promoting exportation, improving the transfer of technology and management of an integrated agro-industrial approach to the development of enterprises is a difficult and complex process. This is why we are collaborating with national institutions and helping to understand the roles which must be played by different entities; the Ministry of Food Production and Marine Exploitation with the Central Marketing Agency has taken the leadership and created the climate where these initiatives can take place. However, the Ministry of Industry, Enterprise and Tourism and the Ministry of Industry, Enterprise and Tourism and the Ministry of External Affairs and International Trade will also have important roles.

This multifaceted approach is paramount as we move towards success. During this seminar you will analyze the main technological advances applied in the business of exporting; discuss the administrative procedures required for export. Discuss marketing opportunities for selected commodities; discuss air and sea transport for horticultural products; discuss packaging materials being used currently in international markets and finally discuss financing for export.

I wish you great success in the workshop and I hope valuable information can be shared and substantive recommendations can be obtained for two reasons: one, that we may learn and two, that you will make money.

OPENING ADDRESS

by

**DR. THE HONOURABLE BRINSLEY SAMAROO
MINISTER OF FOOD PRODUCTION & MARINE EXPLOITATION**

Post harvest technology has been a prominent phrase in the vocabulary of all countries which deal with Export of Agricultural Produce for the past two decades. This phrase can be defined as 'the application of proper technology that would ensure that during the movement of products from farmers to consumers there is no loss in quality or quantity'. In other words how can we ensure that in the transfer of produce from the field to the kitchen, the original quality can be retained.

Our farmers, like other farmers worldwide must now come to terms with the fact that proper post harvest techniques not only prevent losses which can be as high as 50% of production in some developing countries, but that application of these techniques are crucial to the development of a viable agricultural export sector.

Trinidad and Tobago like most developing countries has invested millions of dollars in increasing agricultural production and in spite of these massive inputs of capital, food imports have soared to uncomfortable proportions. In our efforts to correct this we must not only further increase production but ensure that the impact of the production effort is not lost by failure to implement proper post harvest systems internally. In addition, we have to ensure that the income generating capacity of the agricultural export thrust is not jeopardized and that any comparative advantage be lost due to a failure to integrate proper post harvest techniques into our export marketing system. If we fail to continuously upgrade our post harvest practices we shall surely be left behind in a wider world where post harvest technology is being upgraded to a high scientific level.

The need for a seminar such as this is brought into sharp focus immediately as we comprehend the considerable increase in the volume of exports of horticultural products in Trinidad as in the rest of the region, particularly over the last five years. As your workshop brochure indicates, BWIA has reported shipment increases from 300 tonnes in 1986 to 1500 in 1989. In the particular case of Trinidad and Tobago, the Export Development Corporation indicates the following increases between 1986 and 1989:

1986: TT\$1.5 million
1987: TT\$2.7 million
1986: TT\$4.0 million
1989: Approximately 5 million

At the recently concluded meeting of Caricom Ministers of Agriculture a Plan of Action was drawn up for post harvest work in a number of areas where the export potential is highest.

Over the next few years we expect that institutions such as the University and the Caribbean Agricultural Research and Development Institute (CARDI) to be doing much work in the following areas:

1. In fruit and tree crops such as mango, pawpaw and plantain where varietal selection and market identification need to be done. Our scientists have also been commissioned to develop a management package for post harvest maintenance of quality.
2. In the area of vegetable production we requested work in storage methods and in the development of techniques for preservation and processing of onions, tomatoes and ochro.
3. For the root crops namely sweet potato, dasheen and eddoes there will be work on post harvest pest and disease management, grading, packaging and storing.
4. We looked at the legumes: peanuts, beans and pigeon peas and we expect that further work will be done in post harvest and pest and disease management as well as the development of a post harvest package including grading standards, packaging and storing.

It is necessary for people like yourselves, our resource persons, to be acquainted with the objectives of the governments of the region so that you can trim your sails to suit the wind that is currently blowing.

Whilst there is no doubt that the demand for agricultural exports is growing apace, particularly in Europe and in North America we must be constantly aware of the very real limitations which be-devil Caribbean producers. I am certain that you are aware of the majority of these post harvest problems. However, I wish to point out two of them which appear to take precedence over the others and which, thankfully are included in your workshop programme.

The first is the problem of freight which now appears to be a major hindrance to export. Our Ministry together with External Affairs and with Industry and Enterprise is currently seeking to work out ways of tackling this major hurdle. We are not certain as to what we would finally decide but I want to put to you for consideration, some of our thinking. Can we not negotiate with current freight carriers (sea and air) for special long-term rates based on acceptable projections of volumes to utilize empty space on journeys away from the region ie. their homeward trips? Is it possible for the Shipping Association of Trinidad and Tobago

(SCOTT) to be commissioned as an export shipping agency, not only for Trinidad and Tobago but for the Eastern Caribbean aimed at the European market? Is it not possible for some of the nations of the Caribbean to provide warehousing facilities at a few stations in Europe so that CATCO can have secure outlets and active agents in Europe? We still have to address the question of air transport which is shrinking in view of the increasing demands on that medium. What ideas can be expected on this from your Wednesday discussion?

The other major concern has to do with the post harvest processes involved in preparing and processing food from primary production. That is not included in your mainly horticultural sessions at this workshop. Nevertheless many of the same principles apply. There is the need, for example, of appropriate catalogues which are equally important whether one is selling heliconias or pineapples, flavoured drink crystals or foliage. Many of our labels are so dull and unappealing or so outside of conformity to EEC or American standards that high quality produce gets left back. We have to be far more careful about how we contain or package what we export as CARIRI will no doubt tell us on Tuesday afternoon; bearing in mind the need for improved attractiveness to the consumer as well as safety and shelf-life.

At the local as well as at the CARICOM level therefore we must recognize the need for production sharing, joint marketing, common labelling, common standards and quality control. In a world which is increasingly coming together we cannot remain as isolated islands struggling individually. The inter-Caribbean nature of this workshop is a demonstration of that willingness to discuss common problems. We must now go to the next logical step, which is to work together. We must resolve not only to work together but to identify niche markets and seek to produce quality products using the expertise available amongst us. The challenge is now for our farmers' organizations, marketers, traders and exporters to imbibe the knowledge being offered over the next three days. Programmes such as this will be supplemented through smaller workshops, demonstrations as well as the use of the electronic and print media, taking the information to farmers as well as consumers.



C O N C L U S I O N
A N D
R E C O M M E N D A T I O N S

CONCLUSIONS AND RECOMMENDATIONS

At the Workshop a discussion period followed after each presentation. The following is a summary of main conclusions and recommendations.

CONCLUSIONS

1. A Commodity System Assessment Methodology presented by IICA has proved successful in the OECS countries. It was considered a very useful tool to apply to agricultural problems in Trinidad and Tobago. The Central Marketing Agency and several participants were interested in having the support of IICA to learn more about its utilization.
2. There exists a need in the country for research emphasis on packaging material and packaging used in the export of cut flowers.
3. It was demonstrated that there is basic information available to the public at the University of the West Indies and at the Research Unit of the Ministry of Food Production and Marine Exploitation (MFPME) on the post harvest physiology for selected groups of products such as yams, aroids, sweet potatoes, cassava, dasheen, sweet pepper, hot pepper, mangoes, pawpaw, carambola, bread fruit and others.
4. In order to meet the demand of selected markets there is a need to increase production and productivity to decrease the unit cost of production; to have easy access to markets and technical information together with integrated technical assistance. Small farmers need to organize. To achieve this they must on their own make great efforts and commitment rather than wait on the government to do everything.
5. Plant Quarantine Department of the MFPME, despite their present limitations, has available for producers and exporters relevant information and provides technical assistance. They recommend the most important export requirements as follows:
 - a. Pesticides used in the field should not exceed minimum requirements.
 - b. All plant material must be clean, i.e. free of soil, pest and disease.
 - c. The issue of phyto-sanitary certificate from the Plant Quarantine Department.

- d. The satisfaction of phyto-sanitary regulations of the importing country.
6. On the subject of packaging, there is need for proper packaging and labelling, to preserve the product characteristics during marketing and to avoid loss in quality and economic profit.
7. It was pointed out that at the Agricultural Development Bank (ADB), funds are available ie. investment and working capital, for agricultural production and marketing projects. There are no restrictions in terms of the size of the enterprise. The loan can also be short, medium or long term. Special incentives are provided to producer and marketing cooperatives.

RECOMMENDATIONS

1. The farmers must apply good practices during the production cycle such as, correct fertilization, adequate pest and disease control, also careful harvesting and post harvest practices because they are key factors to obtain the high quality fresh produce required for external markets, to diminish unit cost of production and to get higher yield.
2. The air cargo companies recommended the following to exporters in order to obtain a better service:
 - a. To deliver produce at least five hours in advance to facilitate document handling, security and cancellation.
 - b. The use of recommended packing.
 - c. Good labelling for easy and rapid identification and good packaging of the produce for protection and presentation.
 - d. The presence of a reputable agent/broker in the importing country.
3. Producers and exporters must be aware of the laws and regulations, which govern the levels of pesticide residues in food. This is one of the most important aspects for control in the importing countries. CENTENO through the post harvest group of professionals can provide assistance in this field. The Food and Drug Department of the Ministry of Health and CARIRI also have relevant information on pesticide residue levels in food.

4. The exporters should negotiate with freight carriers, both sea and air, for special long term rates, based on projected volumes of produce, in order to utilize available space on trips outside the region.
5. The exporters must keep adequate volumes and acceptable quality of produce, regularity in the shipments of produce and the existence of a reputable agent in the importing country, if they want to maintain a long presence in foreign markets.
6. Private and Public institutions should utilize The Commodity System Assessment Methodology, available at IICA, to identify problems, solutions and formulate programmes and projects. The methodology allows for a better coordination among all the agencies involved, and save time in this kind of activity.
7. It was also recommended that Export Promoting Institutions and the exporters should pay more attention to the ethnic market in Europe, USA and Canada, since the demand for exotic fruits and vegetables has been increased during the last five years.
8. All participants recommended that CMA/IICA organize a course in the specific areas of:
 - Marketing Information Analysis
 - Packaging
 - Technology of Pre and Post Harvest of Cut Flowers.
 - Management of Production and Marketing Techniques for the export of particular commodities such as, Mango, Passion Fruit, Hot Pepper, Pumpkin, Okra.
9. The Government through the Ministry of Food Production and Marine Exploitation should study the possibility of commissioning an export shipping agency, for example, the Shipping Association of Trinidad and Tobago (SCOTT) to handle local and regional exports to foreign markets, eg. Europe.
10. It was recommended by the Customs and Excise Office, that the exporter of agricultural produce make arrangements well in advance of shipment to obtain phyto-sanitary certificates from the Plant Quarantine Division of the Ministry of Food Production and Marine Exploitation to circumvent delays at Customs at the point of export and to facilitate entry of such goods in the country of importation.

T E C H N I C A L P A P E R S

**COMMODITY SYSTEMS ASSESSMENT METHODOLOGY
FOR PROBLEM AND PROJECT IDENTIFICATION**

by

**Jerry La Gra
Marketing/Rural Development Specialist,
IICA Office in St. Lucia**

SUMMARY

This paper summarizes a recently published methodological approach for studying commodity systems (emphasizing pre-production, production, postharvest and marketing aspects), identifying priority problems and formulating realistic solutions to the problems identified. It identifies the type of information which should be collected to give a clear understanding of a commodity system and its inter-relationships. The CSAM methodology has been tested in ASEAN and Caribbean countries and has proven to be a useful method for facilitating inter-institutional and interdisciplinary cooperation in the prioritization of problems and in the identification of feasible development projects.

INTRODUCTION

The decade of the 1990's is to be the decade of reactivation of the agricultural sector. Two international organizations (FAO, IICA) are presently collaborating with governments of Latin America and the Caribbean in the identification and formulation of development projects to make this a reality. Such an effort, however, will demand more than good intentions and development plans, it will require an integrated effort on the part of both the public and private sectors. It will also require the establishment of a common goal to assist our respective rural populations achieve integrated rural development, with all the ramifications that implies. Such a goal can only be achieved through the systematic identification and development of self-sustaining economic enterprises. This, in turn, requires the identification, formulation, funding and effective execution of development projects.

In the decade of the 1990's, the identification and formulation of effective development projects will be one of the key elements in economic development.

Experience shows us, however, that many, if not most, of our developmental efforts are either partial or total failures. One of the main causes for these failures is an inadequate understanding of the causal relationships of the problems associated with a particular situation. Most persons agree that

the greater the level of knowledge concerning a particular problem, the greater the chances of designing an effective solution to that problem. If rational decision makers were given perfect knowledge of a problem situation it would stand to reason that they would also agree on the best solution to the problem.

In reality, however, decision makers often select the wrong "best solution." The reasons for this are many and include such things as:

- misleading or incomplete secondary information;
- over dependency on too few advisors;
- biased nature of the decision makers;
- biased nature of consultants, and
- insufficient time, financial or human resources to properly diagnose problems prior to decision making.

Even when a satisfactory diagnosis has been undertaken within a particular component of a food system, for lack of a comprehensive understanding of that system certain projects may be given the wrong level of priority. This may lead to project implementation at the wrong point in time, resulting in low or even negative impact, e.g. the construction of cold storage facilities before the supporting production and marketing systems are in place.

Given the complex nature of using a holistic approach to problem analysis, some method must be found to orderly collect and analyze information and present it in a form which can be readily understood by decision makers. This "method" must be relatively rapid, and feasible in terms of local resource availability.

In an attempt to develop such a methodology, the Postharvest Institute for Perishables (PIP), the Association of South East Asian Nations (ASEAN) Food Handling Bureau (AFHB) and the Inter-American Institute for Cooperation on Agriculture (IICA) initiated a joint effort in 1985.

During the five year period 1985-90, a number of training and research efforts were undertaken in ASEAN countries, North America and the Caribbean to determine methodological needs and to generate information and instruments for analyzing problems throughout the food system. This resulted, in 1990, in the publication of the manual: A Commodity Systems Assessment Methodology for Problem and Project Identification (CSAM).

METHODOLOGY

If we return to the supposition: "that integrated rural development requires the systematic identification and development of self-sustaining economic enterprises," then a commodity systems

form of analysis is necessary.

Why a commodity systems approach? The development of self-sustaining economic enterprises requires following a market-led form of analysis, i.e. identifying market opportunities prior to planning the production. Since each individual commodity (agricultural crop, animal product, fish, forestry products) has particular production and demand characteristics, it becomes necessary to determine what these characteristics are and how they may impact benefits and costs.

In addition, a commodity system is relatively easy for professionals, farmers, intermediaries and others to understand and relate to. They usually have first hand experience with at least some parts of a commodity system.

Using a commodity systems approach, existing methods and instruments can be easily adapted to collect information, describe the system, identify and prioritize problems and identify and formulate projects. Additionally, a commodity can be studied in a relatively short period of time and the use of an interdisciplinary approach adds to the credibility of the results.

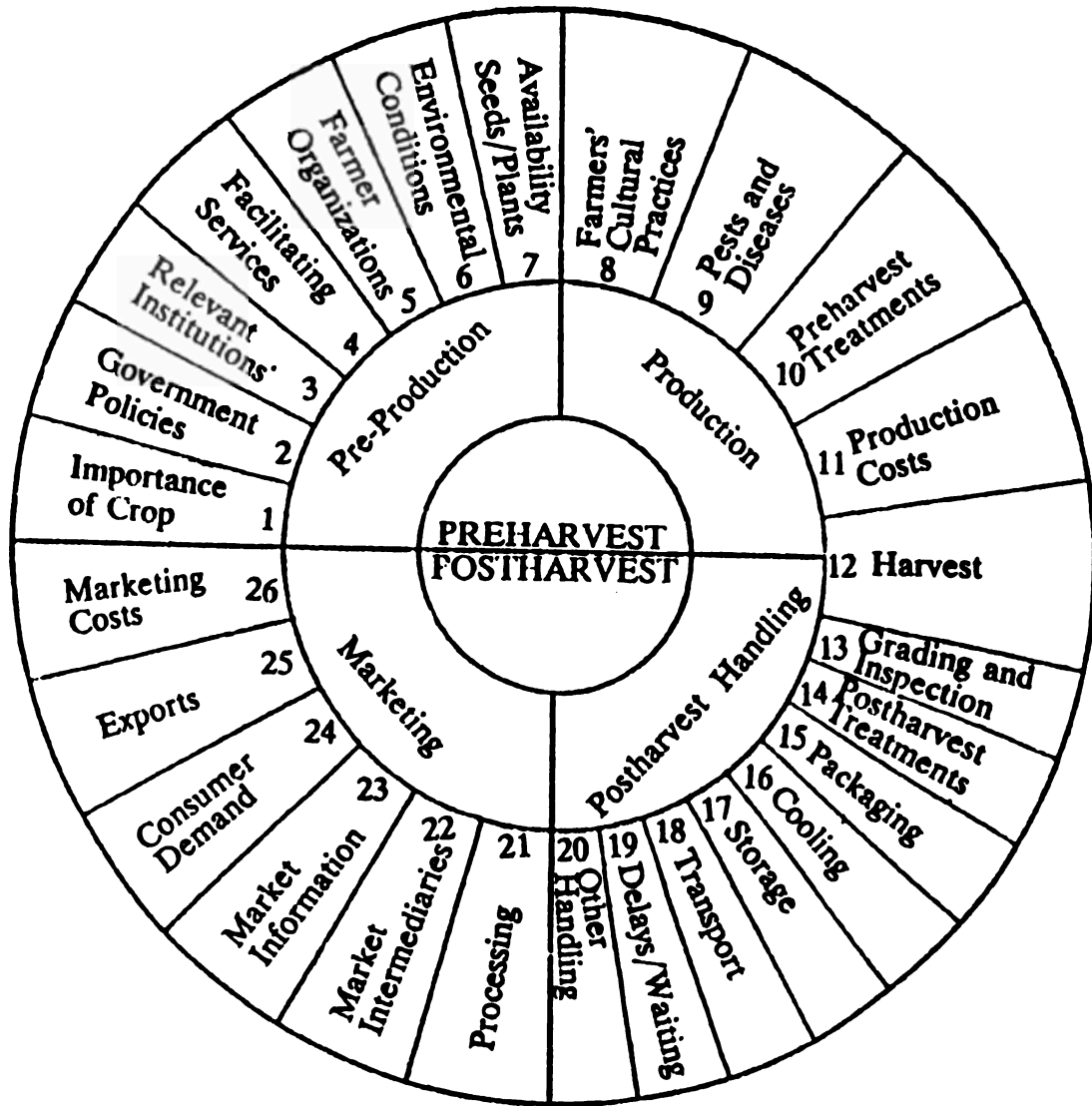
Methodology for Describing the System

As long ago as the mid-eighteenth century, the philosopher Rene Descartes, in his Discourse on Method (Veitch, 1975), pointed out that reality can only be understood by breaking it down into smaller and smaller parts. He suggested the need to divide each of the difficulties under examination into as many parts as possible.

Although the different components of a food system may vary with the crop, country and other factors, a large number are common for most commodities. In Figure 1, twenty-six components are identified. In some cases these "components" are of an institutional nature and focus on participants as diverse as ministries of agriculture, farmers and intermediaries, and the roles each play in the commodity system. In other instances, the components are of a functional nature, such as harvest, storage and transport, concentrating on processes or activities which take place at a particular point in a food system. In still other cases, the component may simply be indicative of a need to provide production or market statistics or descriptive information, e.g. crop environmental requirements and constraints, considered important for the decision-making processes.

The twenty-six components in Figure 1 are presented in a circle format to facilitate presentation and to give some indication of where they fit into the overall commodity system. The centre part of the circle is divided in half, identifying those

Figure 1: Principal Components for a Commodity Systems Assessment



components which fall into the preharvest versus the postharvest stages. Each half-circle is further sub-divided to indicate whether the components deal with pre-production, production, postharvest or marketing.

Each one of the twenty-six components identified in Figure 1 are important in the sense that the decisions or actions occurring at that point may affect production, productivity, quality, regularity of supply or price of the product at that or some later point in the food system. However, **not all of the twenty-six components are relevant for each commodity system.** In some cases a commodity being produced in a particular geographical area may have a very short marketing channel and by-pass steps such as selection, packaging or storage. For example, industrial tomatoes may go directly from the farmers' field to the processing plant. In some cases the researcher may identify other important components which need to be added under particular circumstances. The researcher is free to expand or reduce the list of 26 as she/he sees fit.

For each of the twenty-six components the CSAM includes a description of why that particular component is considered important and the type of information to be collected. An example of a description sheet and GUIDELINE questionnaire for one of the 26 components is presented in Appendix 1. **The questionnaires should always be modified to meet specific needs of the country, the commodity, the geographic area, and the specific interests of the researcher and the institution s/he represents.**

In addition to the description sheets and guideline questionnaires for collecting baseline information, the methodology also includes a variety of formats for organizing and presenting the results. A brief summary of these formats for each major quadrant of the food circle is presented below.

Pre-production

- list of public sector institutions and sub-divisions with a description of their respective functions, responsibilities and services related to planning, research, production and marketing of the commodity being studied;
- identification and description of functions, responsibilities and services of private sector organizations, institutions and associations involved in the production/marketing of the commodity of interest;
- identification and analysis of policies, plans, programs and projects which impact on the commodity of interest;

- comparison of ecological conditions in existing and potential growing areas with environmental requirements of the crop being studied;
- supply and quality of available planting material;

Production

- identification and description of each important step in the production process;
- summary of the production process, answering the six key questions: who? what? how? when? why? and where?
- subjective judgement of the magnitude (quality and quantity) of food losses occurring at each point in the production process;
- subjective/objective judgement as to the technological and economic feasibility of removing causes of significant postharvest losses at points in the production process;

Postharvest

- identification and description of each important step in the postharvest process;
- preparation of a flow diagram of the commodity being studied, indicating temperature, humidity, distance travelled and time required at each relevant point in the postharvest system;
- summary of the postharvest process, answering the six key questions: who? what? how? when? why? and where?
- subjective judgement of the magnitude (quality and quantity) of food losses occurring at each step in the postharvest process;
- diagrams showing estimates of food losses at the main points in the postharvest system;
- subjective/objective judgement as to the technological and economic feasibility of reducing the food losses at each point in the postharvest process;

Marketing

- characteristics of demand (domestic and external) of intended markets;

- national and regional production, imports, exports and apparent consumption;
- seasonality of production;
- quality of national production;
- marketing infrastructure and transportation network;
- production and marketing costs;
- wholesale and retail market prices;

Methodology for Identifying Solutions to Problems

The identification of solutions begins with an analysis of priority problems. Problems are infinite in number. They occur at all points in any commodity system and come in all sizes. Small problems occurring on the farm may become very large problems in the marketplace. Unless we know the causes of the problem we cannot design effective solutions. Any analysis of problems affecting commodity systems must necessarily look for causes throughout the whole system.

The starting point in problem analysis, therefore, should be the identification of as many of the related problems as possible and their respective causes. The more in-depth the description of the commodity system carried out, the larger the number of problems and causes that will be identified. The purpose of the detailed description of a commodity system is to provide an information base for problem identification.

Brainstorming for Problem Identification

Brainstorming is a technique for identifying problems or solutions to problems through a group effort. It is based on the principle that more heads are better than a one.

Brainstorming requires having a discussion leader and someone to write down the problems identified by members of the group. The working group should include the same persons who carried out the description of the commodity system and should draw heavily upon baseline information generated by the respective group (s).

The group leader(s) must insure that the problems presented are existing ones, not potential or anticipated ones or personal opinions.

Once the group can think of no additional problems, the person taking notes should produce a listing of all the problems

identified. This list should be reviewed by each member of the group and modified if necessary until the group is satisfied with the final list. Appendix 2 shows a list of priority problems.

Problem Tree Diagram

A problem tree diagram (see figures 2 and 3) is simply a way of visualizing the cause and effect relationships regarding a particular problem situation. In such a diagram the causes are presented at lower levels and the effects at upper levels. The core problem connects the two. Thus the analogy with a tree.

The more specific the causes the more likely they are to lie at the lower levels of the tree diagram, however, the location of a problem on a tree diagram does not necessarily indicate its level of importance.

There is no one correct way of formulating a tree diagram. Different groups of participants, even when analyzing the same situation, will most likely produce different results. In general, the more complete the level of knowledge of the participants and the longer the time dedicated to analysis, the greater the likelihood of different groups achieving similar results.

The problem tree format gives order to the many problems and their causes in any commodity system. The problem tree facilitates the identification of relationships that otherwise might remain hidden, and they expedite the transfer of understanding of the causal relationships to decision makers and non-specialists.

The tree diagram facilitates the organization of problems into a logical sequence (cause-effect) which will lead to logical conclusions and the identification of cost effective solutions (means-end).

The Problem Tree format can be made as detailed as time and information permit.

The problem analysis is concluded when the working group decides that the essential information is satisfactorily presented in the tree format.

Objectives Analysis

An objective is something towards which an effort is directed. The **objectives analysis**, as used here, is the process whereby the problems identified are converted into objectives or goals towards which activities and actions can be directed. It also includes an analysis of the objectives to determine if they are practical ones and can be feasibly achieved.

In carrying out the **objectives analysis** there are five basic steps:

1. All the negative statements shown on the problem tree are restated as positive statements.
2. All the "objectives" are reviewed to assure that they are desirable ones and realistically achievable in an acceptable time frame.
3. Those objectives which do not meet the conditions mentioned in (2) are modified, deleting those which are undesirable or cannot be achieved.
4. New objectives which are desirable or necessary to complement existing ones should be added to the diagram.
5. The "means-end" relationships thus derived should be thoroughly examined to assure validity and completeness of the diagram. Modifications should be made as necessary.

In the final analysis of each objective, questions should be asked as to whether the achievement of the lower level objectives is sufficient to achieve the next highest objective. In other words, has the cause-effect relationship (expressed in the problem tree) been transformed into a means-end relationship shown on the objectives tree?

Concept of Development Projects

While there are many definitions for "development projects," the important thing is to understand the characteristics of such projects, the more salient ones being the following:

1. Projects have a physical dimension which establish limits to available resources.
2. Projects have a temporal dimension. Since they begin and end at specific points in time they can be differentiated from on-going institutional activities.
3. Projects conform to a well defined unit (group of actions) which can be evaluated to determine the level of success.
4. Projects have clearly defined objectives which tend to be innovative, rather than perpetuating an existing situation.

Therefore, a project is a set of inter-related activities/ actions aimed at a common objective/goal and implemented during a given period of time with a pre-determined quantity of resources (activities + goal + time + resources).

If we accept this definition of a development project we can then prepare a project profile by:

1. Defining its goals, objectives and expected outputs
2. Identifying and describing its principal activities
3. Indicating the resource requirements, and
4. Establishing a time frame for the beginning and ending of the project.

Anyone who has been successful in analyzing a commodity system and identifying priority problems and needs can easily identify project ideas and express them in the form of project profiles.

The key to project identification and formulation is knowing what the priority problems are. Since the CSAM methodology will identify priority problems and organize them neatly in a problem tree, and convert them to objectives in an objectives tree, the writing of a project profile is a straightforward task. That is, once a working group has prepared the Problem Tree and the Objectives Tree, most of the information needed to prepare a project profile is available.

Project Profiles

While different people and organizations use different outlines for project profiles, basically they all contain the same type of information -- albeit presented in a different order. Based on the above definition of a project the following minimum information should be included in a project profile:

1. **Title** (reflects the most important feature of the project; can be obtained from an analysis of the specific objectives).
2. **Definition of problem/justification** (justifies why the project should be undertaken; can be obtained from an analysis of the problem tree).
3. **Goal or general objective** (can be obtained from analysis of objectives tree and development strategies; normally not achievable by the one project alone).

4. **Specific objectives** (can be obtained from analysis of objectives tree; may not be achieved by the one project alone).
5. **Expected output** (specifies the product desired upon completion of the project; can be identified from the lower levels of the objectives tree).
6. **Activities** (actions to be implemented to achieve the expected outputs).
7. **Duration** (period of time needed to execute project; determined by the time required to complete all project activities in their proper sequence).
8. **Costs** (derived from an estimate of the costs of the inputs required to implement the diverse activities).
9. **Implementing institution, organization or group** (identifies the public/private institution responsible for execution; determined through an evaluation of organizational capability, source of funding and local politics). (See example in Appendix 4)

DEVELOPMENT OF THE METHODOLOGY

The CSAM was developed over a period of five years based on a series of investigative and training experiences. The more significant of these events are summarized below.

In 1986, IICA and the Caribbean Development Bank (CDB) initiated a study of the production and marketing constraints of fruit systems in the Windward Islands of the Caribbean. This comprehensive study (La Gra and Marte, 1987) was carried out over a period of 18 months, using a commodity systems approach applied to seven specific fruits in four different countries. The results served as the basis for the formulation of the OECS Diversification Programme.

In an attempt to develop a comprehensive methodology for analyzing commodity systems, from a postharvest point of view, PIP, AFHB and IICA formed an interdisciplinary team in 1986 to visit ASEAN countries and identify common problems and needs of both public and private sector institutions dealing with postharvest problems. As a result of numerous consultations with professionals in five countries, the first draft of the CSAM manual was prepared.

In 1987, the University of California at Davis, and PIP at the University of Idaho, with support from the US Agency for International Development (USAID), the United Nations Food and Agricultural Organization (FAO), and IICA, combined forces in the

organization of a training course for 20 technicians from the Eastern Caribbean. The training concentrated on methods for reducing postharvest losses in perishables, based on a commodity systems approach. Participants were divided into four interdisciplinary teams. Each team used a commodity systems approach to prioritize problems and to identify solutions, with the ultimate goal of identifying ways to improve the production and marketing of specific food crops in specific Caribbean islands (PIP, UCDAVIS, 1987).

In 1988, the Heads of State of the Organisation of Eastern Caribbean States (OECS) requested the Caribbean Agricultural Research and Development Institute (CARDI), CDB, and IICA to prepare an OECS Diversification Programme for the export of non-traditional crops. This Programme was prepared in 1988, using a commodity systems approach (CDB, IICA, CARDI, 1988), and is now being implemented.

Based on the above experiences, the present manual was compiled in 1988 in draft form. During the period June 13-25, 1988, it was field tested in Malaysia at the Malaysian Agricultural Research and Development Institute (MARDI), under the joint sponsorship of MARDI, AFHB, PIP and IICA. During the two week in-service workshop, 24 MARDI professionals, covering 12 disciplines, applied the methodology, step-by-step, as presented in CSAM. The end result was a case study (MARDI, 1988) on carambola (star fruit) which describes the system, analyzes the problems, identifies possible solutions, and outlines four project ideas in project profile format.

In April 1989, PIP applied the methodology to the case of ginger in Nepal. Modifications in the workshop were initiated based on the educational backgrounds of participants (farmers, intermediaries, extension officers) and their estimated knowledge of the subject matter. The workshop was shortened to one week and a case study was completed (McCullough and Haggerty, 1989) on ginger handling and marketing. The system was described, problems analyzed, and potential solutions were identified.

The above experiences demonstrated that the CSAM methodology can be used under a wide variety of circumstances and can be modified to meet the needs of almost any type clientele. In general, the application of the methodology requires the following five steps:

- 1st: Preparation of basic documents (prior to any workshop) including baseline information on the pre-production, production, postharvest and marketing of the commodity of interest.
- 2nd: Formation of inter-institutional and inter-disciplinary teams.

3rd: Collection of missing information and description of the commodity system (pre-production, production, postharvest and marketing).

4th: Identification and analysis of problems.

5th: Identification of solutions: projects and strategies.

CONCLUSIONS

1. Due to the comprehensive nature of any food system and limited resources for analysis, there will always be the risk that the CSAM will over simplify the situation. Along the same lines, there is the possibility that participants information on local crop conditions/circumstances may be mistakenly generalized to the whole country.
2. The CSAM methodology requires support from a diversity of institutions and individuals. Due to multiple reasons, it may not always be possible to obtain this support.
3. The key person in the application of the CSAM is the resource person coordinator, who must have a broad base of experiences and knowledge and be able to work effectively with groups and people in general. This key person may not always be easy to find.
4. The reaction from professionals who have participated in the application of the CSAM methodology have, in general, been very positive.
5. The CSAM has proven to be flexible and readily adaptable to circumstances in a variety of countries.
6. The CSAM is an effective method to stimulate inter-institutional and inter-disciplinary coordination and integration.
7. The CSAM can produce results in a relatively short period of time and it facilitates the organization of decision making information into a readily usable form.
8. By bringing together a large number of people with different training and experiences, but common interests, CSAM facilitates reaching group consensus in respect to priority problems and their causes, as well as priority solutions.
9. The CSAM is effective in the identification of actions, projects and strategies to overcome priority problems.

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Appendix 1

PREHARVEST TREATMENTS

COMPONENT 10

Preharvest treatments, either physical or chemical, may have a favourable impact upon postharvest quality. Examples of treatments include such things as:

- a. The gathering of cauliflower leaves around the head prior to harvest to prevent yellowing
- b. Twisting of cabbage (90 degrees) before harvest to break some roots and induce wilting; this causes the wrapper leaves to tighten, thereby helping to protect head during postharvest
- c. Wrapping fruit while still on tree, eg. apples, carambola (star fruit) and bananas may be wrapped with paper or plastic to prevent attack from birds, fruit flies and other pest or to enhance ripening or fruit colour
- d. Chemical treatments while in the field to extend postharvest storage life or enhance marketability, eg. applying sprout inhibitors on potatoes or ethereal on apples to increase the red colour.

In some cases chemical application can lead to postharvest residues which create marketing constraints.

All physical and chemical preharvest treatments which affect the postharvest quality of the commodity under study should be identified.

The information to be collected includes:

- a. Identification and description of physical and chemical treatments used on the commodity under study.
- b. Description of why, when and where each action is taken.
- c. Identification of the type of participant carrying out the action.
- d. Description of what impact the action has on:
 - quantity of production
 - quality of production
 - storage life
 - marketability, and
 - price of product.
- e. Identification of possible alternative treatments.

f. Others to be determined. (See Guide Questionnaire Component 10 below)

COMPONENT 10

Preharvest Treatments

NAME OF DATA COLLECTOR: _____ TEL: _____

TITLE: _____ INSTITUTION _____

1. Do the farmers in the region carry out any type of physical treatment to the crop prior to harvest which may affect production or its postharvest quality? Yes () No ()

If yes, please describe each treatment:

a. Name of physical treatment _____

b. Description of action taken _____

c. Why is this action taken? _____

d. Who carries out the action? _____

e. When is the action carried out? _____

f. Description of the impact of results of the action taken (how is the quantity, quality, storage, shelf life, market value, etc., affected?)

2. Do farmers in the region carry out any type of chemical treatment to the crop prior to harvest which may affect production or its postharvest quality? Yes () No ()

If yes, please describe each treatment:

a. Name of chemical treatment _____

b. Description of action taken _____

c. Why is this action taken? _____

d. Who carries out the action? _____

e. When is the action carried out? _____

f. Description of the impact or results of the action taken (how is the quantity, quality, storage, shelf life, market value, etc. affected)?

3. Are there recommended treatments which farmers are unaware of or do not use for some other reason? Yes () No ()

If yes

a. Name of treatment _____

b. Purpose of treatment _____

c. Why is it not used by farmers? _____

4. Identify and describe other preharvest treatments which might favourably affect postharvest quality.

a. _____

b. _____

c. _____

d. _____

5. Summarize the problems resulting from preharvest treatments which may affect production, processing, postharvest and marketing of the crop.

1.

2.

3.

4.

5.

Appendix 2

An example of a list of priority problems in the production of quality papaya is presented below:

- | | |
|-----------------------|--------------------------------------|
| - credit | no loan portfolios for fruit |
| - planting material | susceptible to bunchy top |
| - farm inputs | proper type unavailable |
| - technical know how | proper techniques unknown |
| - water | poor distribution of rainfall |
| - wind damage | lack of windbreaks damages fruit |
| - on-farm handling | lack know how for handling/packing |
| - packing shed | facilities not available |
| - infrastructure | no facilities for canning & freezing |
| - low domestic demand | due to high per unit cost |
| - high level imports | temperate fruits imported |

Figure 2 presents the above list of problems in a problem tree format.

The core problem is: "Low level of national production of papaya." This produces two undesirable effects: non-exports of papaya, which leads to the loss of opportunity to earn foreign exchange; and low domestic supply of papaya, resulting in high prices and imports of temperate fruits. These lead, respectively, to inflation and losses of foreign exchange.

The problems causing this situation have been identified in the lower part of the problem tree. On the one hand the services offered to farmers are very poor and on the other the quality of papaya is very low. Each of these problems has its causes which are identified in the lowest level of Figure 1.

Figure 2 shows how to convert problems (cause-effect) into objectives (means-end) by converting them into positive statements.

An analysis of the problem and objectives trees facilitates the identification of project ideas. One such project, derived from Figure 2, is presented in project profile format.

Figure 2: Problem Tree showing cause and effect relationships in the production and marketing of papaya

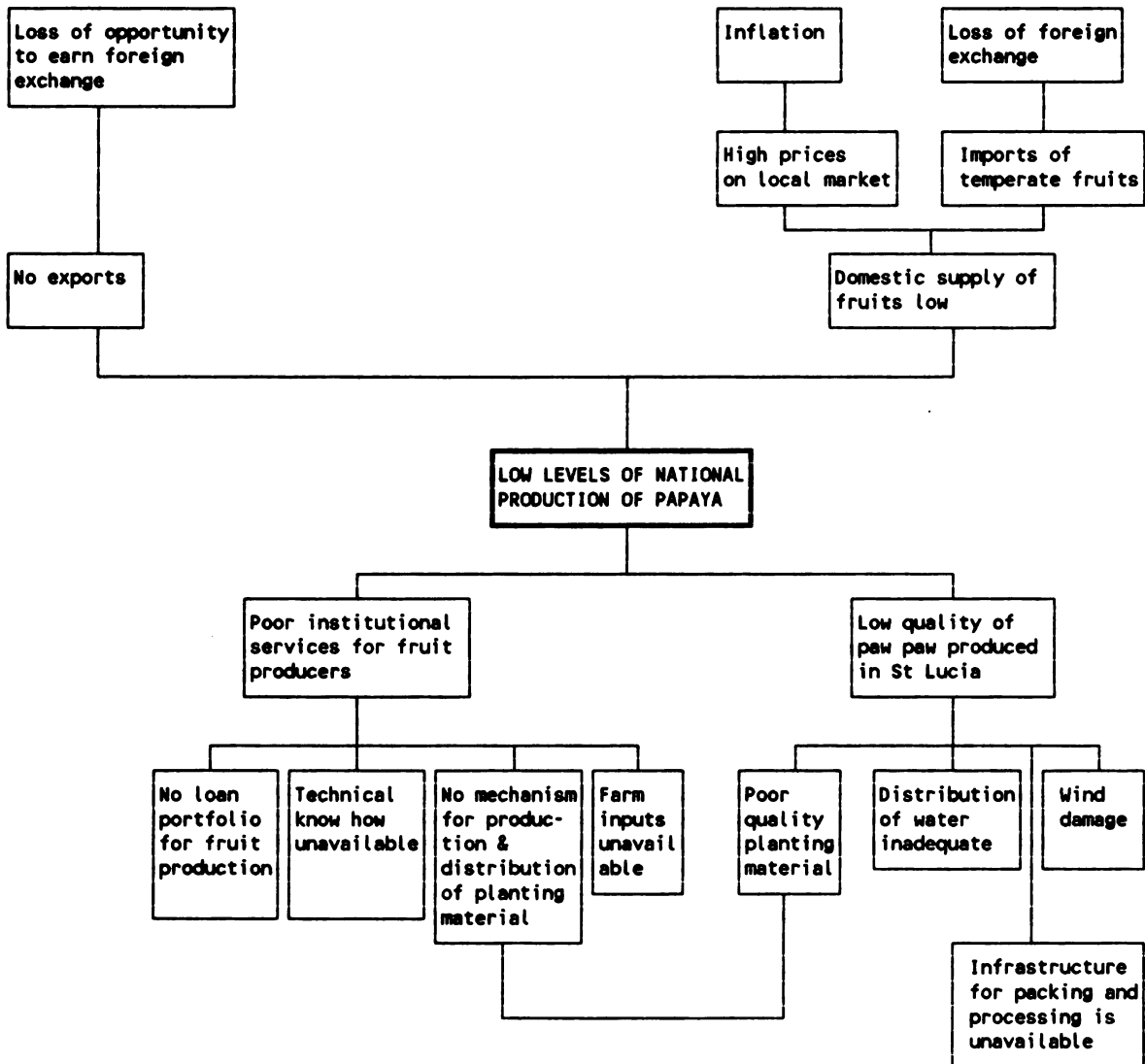
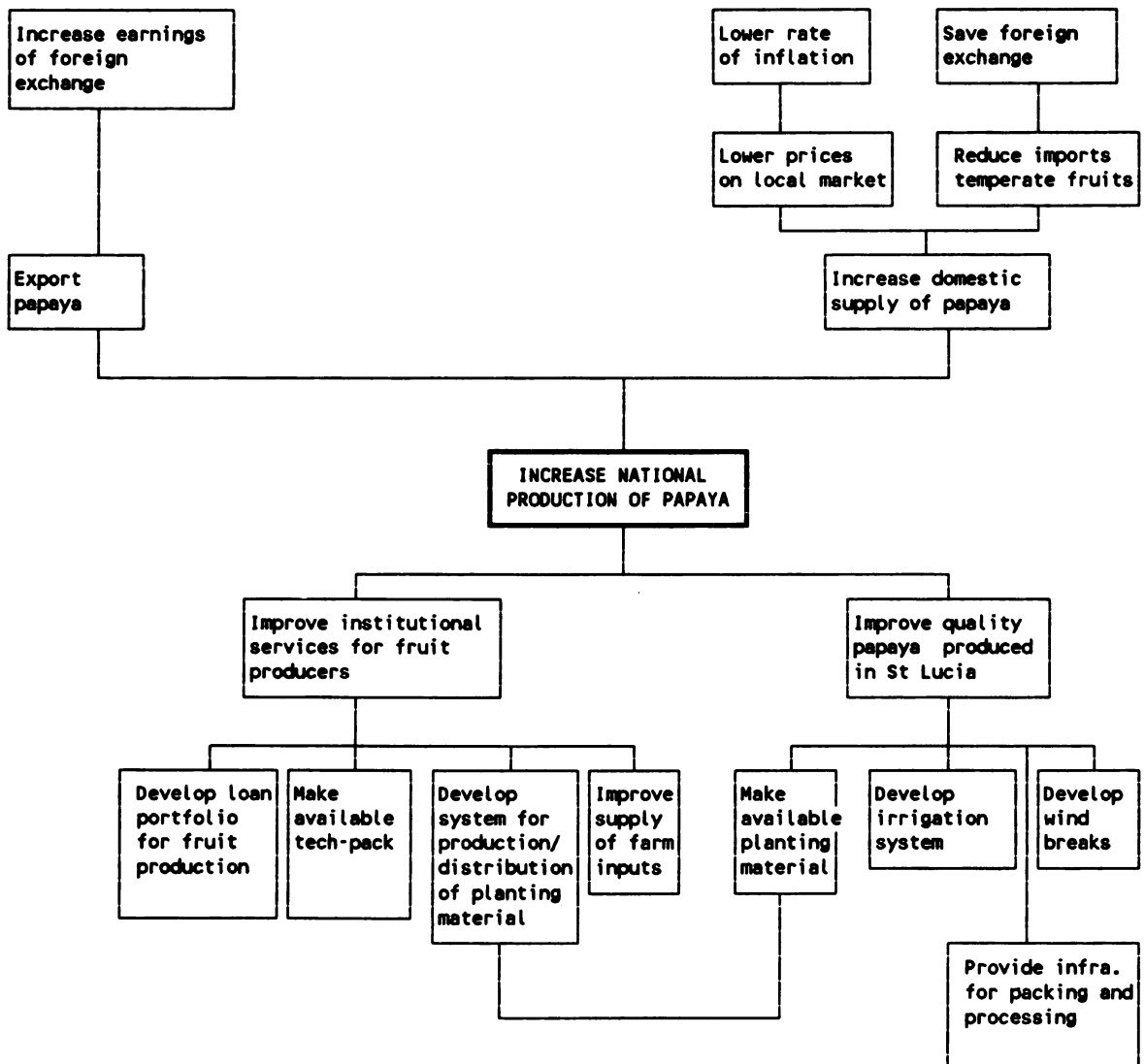


Figure 3: Objective Tree generated from Figure 1 (Problem Tree)



**APPENDIX 3
EXAMPLE OF A PROJECT PROFILE**

Title: INSTITUTIONAL DEVELOPMENT FOR FRUIT PRODUCTION

Definition Of Underlying Problem: Due to the absence of disease resistant planting material and poor cultural practices brought about by the lack of a governmental policy in favour of commercial fruit production and poor institutional services, fruit production is low. This results in a high level of fruit imports and almost no fruit exports.

Goal: Increase the domestic supply and exports of good quality fruit

Specific Objective: Improve the production and marketing services available to fruit producers

Expected Outputs:

- Improved planting material for papaya and other fruits.
- Established research programme to maintain the quality of planting material.
- Tech-packs for the production, postharvest handling and marketing of paw paw and other fruits.
- Established effective mechanisms for the production and distribution of planting material.
- Well trained staff in the planting material production unit.
- Effective system for the distribution of farm inputs.

Activities:

- Import and reproduce improved varieties of planting material of selected fruits.
- Research into proper production, postharvest handling and marketing techniques and initiate validation activities.
- Prepare and reproduce tech-packs for distribution to extension agents and farmers.
- Establish pest and disease free nurseries for planting material.

Train Ministry agronomists and research staff on proper techniques for the production of planting material.

Set up the organizational structure for the distribution of farm inputs and planting material through farmer organizations.

Expected Duration:

This project will have a duration of three (3) years.

Estimate Of Costs:

(US\$)

<u>Type Expenditure</u>	<u>Estimated Cost</u>
- import of plant material	\$ 3,000
- preparation tech-packs	40,000
- nursery establishment	120,000
- training	20,000
- technical assistance	25,000
- miscellaneous	<u>21,000</u>
Total	229,000

Implementing Agent:

Ministry of Agriculture

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**POST HARVEST HANDLING SYSTEMS FOR TROPICAL CUT FLOWERS,
FOLIAGE AND POTTED PLANTS**

by

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THE PLANT INTACT

Generally, the intrinsic life of the flower corresponds with the same number of days it can last in the vase.

The plant, while still intact, can make the substances that are necessary for floral development through photosynthesis. This is the fundamental process of the manufacture of sugars using water, carbon dioxide and solar energy which occurs in the leaves.

It is important to note that in the intact plant there is equilibrium between the activity of the organs above ground and the roots.

This equilibrium is maintained through the hormones made by the axil meristem and root meristem.

Disruption of the equilibrium (after the flower is harvested)

There is disruption in the equilibrium between the above ground parts and roots once the flowers are harvested.

The equilibrium between respiration and water up-take is restored through water uptake by the cut.

In the cut flower, therefore, there is no more selectivity by the roots hence the flower or foliage indiscriminately absorbs mineral salts from whichever solution it is dipped in.

Some leaves have phenolic substances that are re-absorbed by the cut stem and thus are toxic for the flower when they are released in the vase.

Water balance of the cut flower

The primary consideration for cut flower survival is the water balance which also conditions the cellular turgidity.

Water is lost by evaporation and replaced by up-take of water through the stem.

Type of stem cut

Whether the stem is cut in a bevelled or straight manner, it does not affect water up-take since neither stem diameter nor the number of exposed vessels change. A bevelled cut is recommended however, because it is easier to carry out and inflicts less damage on the cut vessels.

The action of ethylene

After removal from the intact plant, the release of ethylene is one of the characteristics of cut flowers. Some research workers believe that the release of this ethylene is associated with senescence.

Many treatments (eg. the addition of glucose) are aimed at delaying 'this' ethylene crisis.

The physical phenomenon of senescence causes variations in the permeability of the cells with subsequent release of potassium and various pigments.

Senescence of the cut flower and foliage

In order to better understand the phenomena that occurs during the separation of the flower or foliage from the mother plant, it is useful to examine the entire plant.

After being cut, the flower lives on reserves and there is a slowing down in its capacity for biosynthesis and respiration and therefore, an alternation in the percentage of water, proteins and sugars as well as ethylene synthesis. From the second day after harvest, we can note a decrease in weight due to a decrease in water in the stems partially because of blockages in the vessels due to the formation of calluses.

Rapid degradation of proteins is also observed. This causes the release of amino acids and ammonia. In the petals this results in the release of toxic compounds causing pigments to be destroyed and alteration of colours.

Survival of cut flowers and foliage

To delay the fading of the flower therefore it is necessary to:

1. ensure the circulation of water
2. provide the energy-giving elements that are necessary to keeping the plant parts alive
3. decrease the sensitivity of the flower to ethylene.

With regard to (1) the slowing down of the circulation of water in the stem is due to the appearance of calluses in the vessels of the stem. These calluses have two origins: (a) either fungus or bacteria and (b) products of the enzymatic oxidation. In order to avoid fungal or bacterial formation it is useful to add an antiseptic agent.

In order to retard oxidation it is necessary to increase the acidity of the environment. This explains the reason for adding an acid agent.

In order to delay senescence, we also have to feed the flower with sugars that will allow biosynthesis to continue and favour flower longevity.

This can only be ensured if the water balance is not disturbed and the supply of sugars is accompanied by water treatment substances.

Nutrient solutions are therefore composed of glucose and saccharose, an antiseptic agent and an acid agent.

Neutralizing the ethylene effect

The addition of thiosulphate agent can retard ethylene production once the cut flower is treated soon after harvest.

THE QUALITY CHAIN

The treatment of the flowers and foliage is not only aimed at making them more attractive at the florist's window but must be capable of prolonging life after consumer purchase. At purchase, the flower or foliage should be turgid and the reserve level is at its maximum.

Basic rules

1. The flowers must not stay too long without water.
2. Avoid storing the flowers in zones where the temperature is too high.
3. The room where the flowers are packed must be cool or it must have a cooling system.

Pre-treatments

Pre-treatments help the flower to last during distribution and the particular treatment depends on the flower species.

For the tropical flowers and foliage, antiseptic, antifungal and insecticidal treatments are successful.

Main products sold abroad

- Anthurium (pink and hybrid)
- Pink and red ginger
- Torch ginger
- Heliconias
- Various foliage

Packaging

Packaging decreases the loss in water due to respiration during transportation.

It permits water vapour to escape avoiding condensation and thus, the development of floral diseases.

Two types of packages are used:

- winter package
- summer package.

Transport

The flowers have to be well packaged in order to reduce stress during transport but wholesalers and florists must have infrastructure that can accommodate tropical flowers (15-18°) and must avoid opening the boxes in cold air currents in winter.

Flowers must be protected against ethylene. (Especially anthuriums). On receipt, the florists must re-cut the stem (bevelled) and they must be dipped in water.

Do not store the flowers in closed rooms.
Do not store the flowers near fruits.
Do not smoke without airing.

Importing countries ask for:

1. Large shipments and regular quality, fresh products.
2. Packaging adapted to climatic variations.
3. Various quantities of the package according to the products:

Flowers: fifteen to sixteen flowers per box with at least five leaves. Anthuriums with tubes at the end of the stems.

Foliage: sold in bunches, mixed calibre, various species.

The package should also show a quality mark, phyto-sanitary approval, a picture of the contents, the date of packaging and the date of shipment.

CONCLUSION

Producer-consumer considerations.

Producer

1. Conditions of culture adapted to the plant culture (fertilizer NP K balanced).
2. Strong stems - straight - lovely colours, good leaf quality.
3. Phyto-sanitary treatment - healthy flower and leaf.
4. Respect for the level of maturity (better quality and conservation of the product).
5. Pre-treatment of cut flower and foliage. Having the flower dipped in water help to keep them fresh. Adequate packaging - resistance to weather conditions in temperate climates.
6. Carrier: Respect for the fragility of the product. Storage in zones of 15 to 18° with 70-80% humidity.
7. Wholesaler: Dynamism of the selling - quick selling for the florist.

FINAL CONSUMER

1. Quality product, good state of conservation.
2. Confidence gained hence repeat buying.

THE TROPICAL ROOT CROPS - POST HARVEST QUALITY AND HANDLING SYSTEMS FOR QUALITY MAINTENANCE

by

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INTRODUCTION

In tropical countries, the magnitude of postharvest losses is generally reported to be high although few reliable figures are available. Losses are known to occur at all stages in the production chain. although there has been increased emphasis on reduction of postharvest losses in recent years, it is becoming even more apparent that there is need to improve management of food resources and increase and regularize supply in order to improve food availability. This can best be achieved by the application of appropriate postharvest technological principles to the harvesting, handling and storage of tropical crop commodities. This paper addresses the application of handling systems with particular reference to the tropical root crops.

The tropical root crops produce, except in the case of cassava, organs that serve both functions of perennation and propagation. Thus they seem naturally to have extended shelf lives and generally, under tropical ambient conditions, their storage is achieved more easily than other types of horticultural produce. However, they share in common with other types of produce, a wide range of postharvest problems which must be addressed if successful management is to be achieved. The success of a postharvest management system can best be gauged by reference to the degree of quality maintenance as measured by specific quality components.

FACTORS AFFECTING QUALITY

As for other horticultural produce, the postharvest maintenance of quality, ie. control of the rate of deterioration and senescence, is imperative to the successful marketing of the tropical root crops. This is influenced by many factors which fall into several major categories:

1. Genetic Factors

The most important factor is variety/cultivar selection as it affects

- produce quality components - skin, colour, shape, size,

flesh colour, cooked texture, etc.

- adaptability to the growing environment and the ability to withstand adverse environmental changes
- pest and disease resistance.

2. Preharvest Factors

As would be expected, the growing environment and field cultural practices play an important role in determining postharvest quality. The following are of major importance in the production of the root crops:

- soil type and crop nutritional status - affect overall yield, tuber shape, size, dry matter content and texture.
- water supply - affects plant yield and overall tuber quality.
- plant spacing - affects individual tuber size and shape and yield per plant.
- mulching - affects water relations and consequently yield, tuber appearance and internal quality.
- pest and disease control - yield and overall tuber quality.

3. Produce Maturity

Ideally produce should be harvested at the stage of development when it is best suited for its intended use or when desirable characteristics can be achieved as a result of post harvest processes. The stage of maturation at which root crops are harvested influences:

- susceptibility to mechanical injury
- susceptibility to pathogenic invasion
- susceptibility to pest attack
- rate of metabolic activity and thus rate of senescence
- the ability to undergo growth and development processes, eg. curing, sprouting.

4. Harvesting Operations

The method of harvesting especially in areas of low

technological development often poses the major cause of postharvest deterioration due to the extent of mechanical injury suffered by the produce.

Abrasions, scrapes, bruises, punctures, cracks and crushing or compression injury all should be avoided. Such injuries:

- detract from the appearance of produce
- increase rates of water loss from produce
- provide sites of entry for even weak pathogens
- lead to development of off-colours and off-flavours and influence texture
- increase metabolic rate and rate of senescence.

POSTHARVEST PHYSIOLOGY OF THE TROPICAL ROOT CROPS

The postharvest physiological behaviour of each crop species determines not only the potential storage life of the harvested commodity but also the type of handling system which must be applied for best results.

The Cassava

The postharvest storage life of cassava roots is characterized by the development of vascular streaking (Averre 1967), a physiological disorder characterized by discoloration of the vascular system, within 1 to 7 days after harvest (Montaldo 1973). The postharvest deterioration has been found to have two components. The first, termed primary deterioration, has been attributed to physiological causes (Booth & Coursey 1974, Booth 1976), characterized by a wound response during which various polyphenolic compounds are synthesized (Rickard 1985). The second, termed secondary deterioration, is ascribed to pathogenic invasion of the tissue (Booth 1976). Both types of deterioration need to be controlled if storage methods for holding cassava roots, either for processing or fresh use, are to be effective.

Several methods have been formulated to prevent the development of vascular streaking. The important factor, common to most methods, has been the prevention of moisture loss from the roots after harvest. Additionally, curing of roots also occurs under these conditions of high temperature (25° - 40°) and high relative humidity (Booth 1975). Accordingly, storage in moist media (eg. peat, soil or sawdust), waxing and storage in plastic bags or films, have all been successfully used to control the development of vascular streaking. Generally, recommended methods for successful cassava storage have been reported to maintain roots

of acceptable quality for about 4 weeks (Marriott, Been & Perkins 1974, Aiyer, Nair & Prema 1978, Oudit 1976). However, for utilization of cassava roots as a boiled vegetable, the prevention of vascular streaking is not the only consideration. The appearance and cooking quality of the roots are also very important. Loss in quality in the form of changes in texture of the cooked root, is known to occur in cassava with time. Instead of cooking to a mealy, floury or soft texture, characteristic of the particular cultivar, the root boils to a hard, crunchy consistency with a translucent appearance and is unpalatable. This condition is particularly noticeable with roots harvested after a period of field storage and after periods of prolonged storage (Wickham and Wilson, 1988).

THE YAM

Programmed into the growth cycle of the yam is the regeneration of the vegetative growth phase through the institution of the primary nodal complex (PNC) (Ferguson, 1972). This organ has been recognized as the primary organ of propagation in *Dioscorea* species (Wickham, Wilson and Passam, 1982), originating at the base of the axillary bud, the hypocotyl of the germinated seedling or the tuber meristem of the tuber, and possessing the capacity to produce roots, shoots and the tubers of the succeeding generation.

This activity, necessary to the continued existence of *Dioscorea* spp. results in regrowth in the tuber after a predetermined period of dormancy, constitutes the period of natural storage of the yam tubers.

At the onset of sprouting, the developing PNC becomes the organ of translocation of the stored reserves in the yam tuber and endogenous water and stored carbohydrates (mainly starch) are utilized in sprout and root development as the next vegetative phase begins in the growth cycle. The result of this activity is qualitative deterioration and quantitative losses in stored tubers. Thus weight loss, shrivelling and compositional changes reduce the acceptability of the tuber for food.

The mechanism for mobilization of assimilate for germination in the yam is so vigorous that virtually all stored material is transferred from the tuber to the organs (vines and tubers) of the succeeding cycle. As a result, the onset of germination signifies the end of the successful period of storage of yams for human consumption and the metabolic intensity of the sprouting process limits the period during which the sprouted tuber can be used as planting material, further entrenching a definitive rhythm in the cyclic pattern of growth.

Therefore, the length of dormancy is the most important determinant of the shelf life of the yam and consequently of availability of the yam for food. It also influences the texture

of cooked tubers and the availability of fresh tubers through its effect on the cyclical pattern of yam growth and development.

THE SWEET POTATO

There are extensive varietal differences among the sweet potato tuberous roots with respect to post harvest behaviour. Perhaps the most important is the length of time to sprouting after harvest because of the effects of sprouts on the appearance and other quality parameters of the tuber. This varies with variety and age of the tubers at harvest, as well as with environmental conditions during growth and storage. Another important factor in postharvest deterioration of the sweet potato is the rate of water loss and consequential shrivelling. For many varieties the latter reduces marketability long before sprouting becomes a problem.

THE AROIDS

The major postharvest problems of the aroids and especially the dasheen (*Colocasia esculenta*) are pathological in nature. Provided that through an integrated programme, these can be avoided, then postharvest moisture loss and sprouting of the corn become the major problem. The aroids respond well to curing and successful storage can usually be achieved subsequently if there is no further mechanical injury.

HANDLING SYSTEMS FOR QUALITY MAINTENANCE

a. Handling and transport systems

All care during preharvest production and the harvesting operation can be made of no effect if improper handling and transport systems are utilized. Here the emphasis must be on

- i. avoidance of mechanical injury
- ii. minimizing the number of handling steps
- iii. use of appropriate packaging during handling and transport
- iv. availability of appropriate infrastructure to facilitate these operations
- v. avoidance of adverse environment during handling and transport eg. modified atmospheres, excessively high temperatures, build-up of high ethylene concentrations.

b. Specific postharvest treatments

Specific postharvest treatments can be applied to improve the natural storage life of the tropical root crops. Those with

greatest practical application include

- i. postharvest treatment with antimicrobial agents. This should be a routine application for all types of root crops.
- ii. curing to seal wounds thus reducing water loss and the possible sites of entry of pathogens. Curing is beneficial to all root crops.
- iii. waxing to reduce moisture loss from the surface thus reducing shrivelling and weight loss while improving appearance. Waxing is particularly beneficial in the sweet potato, the cassava and some yam varieties.

c. The storage environment

The correct storage environment is essential to extend shelf life. Important aspects include:

- i. temperature.
- ii. control of relative humidity.
- iii. pest and disease management.

i. Temperature:

Temperature control can be regarded as the most important single factor used in extending the shelf life of perishable produce. Generally, storage life increases as storage temperature falls. In the tropical root crops the lower limit for temperature is set by the point at which chilling injury occurs. This temperature varies for the different root crops eg. chilling injury occurs in the sweet potato at temperatures below 9°C and in yams at between 10°-12°C while cassava can be stored successfully at far lower temperatures. The upper limit for storage temperature is set by the effect of temperature on enzyme activity. Consequently, there is an increase in metabolic rate and rates of deterioration as temperature increases. Prolonged exposure to high ambient temperatures reduces the shelf life of all the tropical root crops. If this is combined with high relative humidity sprouting is accelerated as well.

ii. Control of Relative Humidity:

The regulation of relative humidity (RH) in the postharvest situation is extremely important. It is essential that commodities be stored at the optimum RH for successful quality maintenance. Generally, too low relative humidity encourage surface mould growth and sprouting. Except for the cassava,

contact with free moisture during storage should be avoided at all cost.

iii. Postharvest Pest and Disease Management:

Pest and disease incidence in the postharvest environment adversely affect produce quality. Management must include the preharvest situation, since the field is in most cases the source of inoculum and postharvest pests. Events during harvesting operation and postharvest handling systems often predispose produce to pathological invasion. These include:

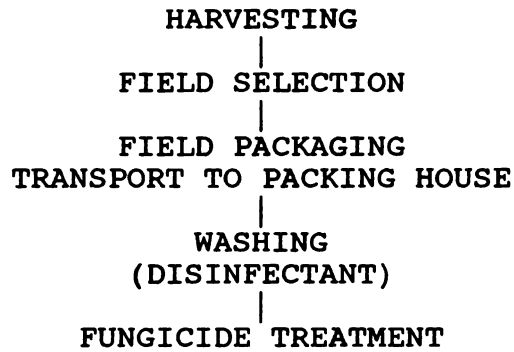
1. the assembly of produce in convenient units for handling, storage and marketing
2. the protection of the produce during all postharvest operations.

Both functions are absolutely necessary in the handling of tropical root crops. A range of packaging material is now in use and the primary objective must always remain the selection of appropriate packaging for a given type of produce under specific conditions. For example, packaging should ensure adequate ventilation for yams, sweet potato and the aroids while giving minimum ventilation and protection against moisture loss for cassava.

Despite the application of general principles, the specific postharvest physiological activity of a particular root crop species or cultivar exerts major influence on the postharvest life. Consequently the handling system applied must bear reference to the major specific problems identified for each type of root crop.

Given the nature of the root crops - high moisture, high carbohydrate content, bulkiness - handling systems used should emphasize speed, simplicity and a minimum of steps. Following are the basic steps in handling systems for the major root crop groups:-

HANDLING SYSTEM - CASSAVA

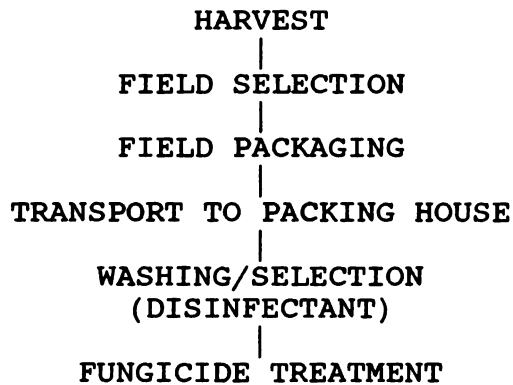


MOIST
BAGGING

WASHING

PACKAGING IN
MOIST MEDIUM

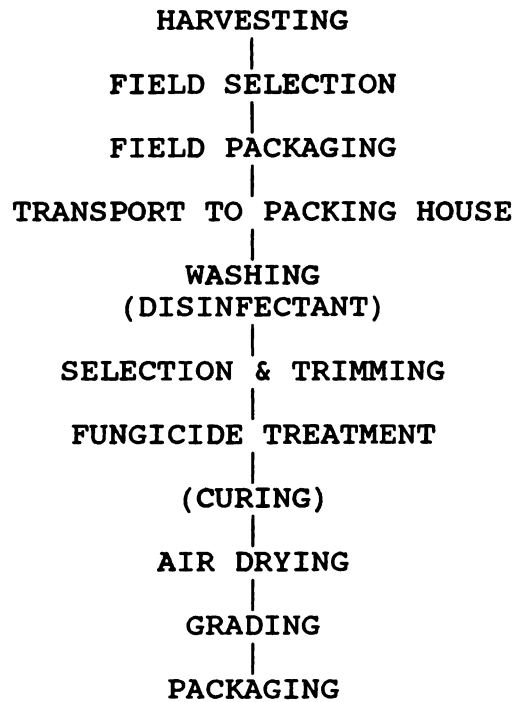
HANDLING SYSTEM - EDDOE AND DASHEEN



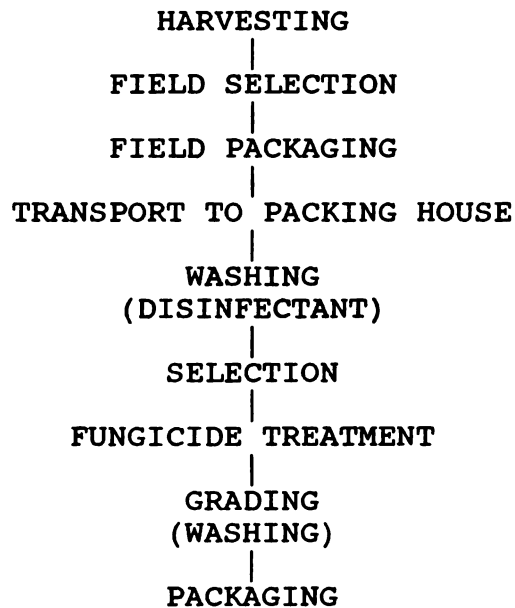
AIR DRYING
PACKAGING

CURING
AIR DRYING
PACKAGING

HANDLING SYSTEM - YAMS



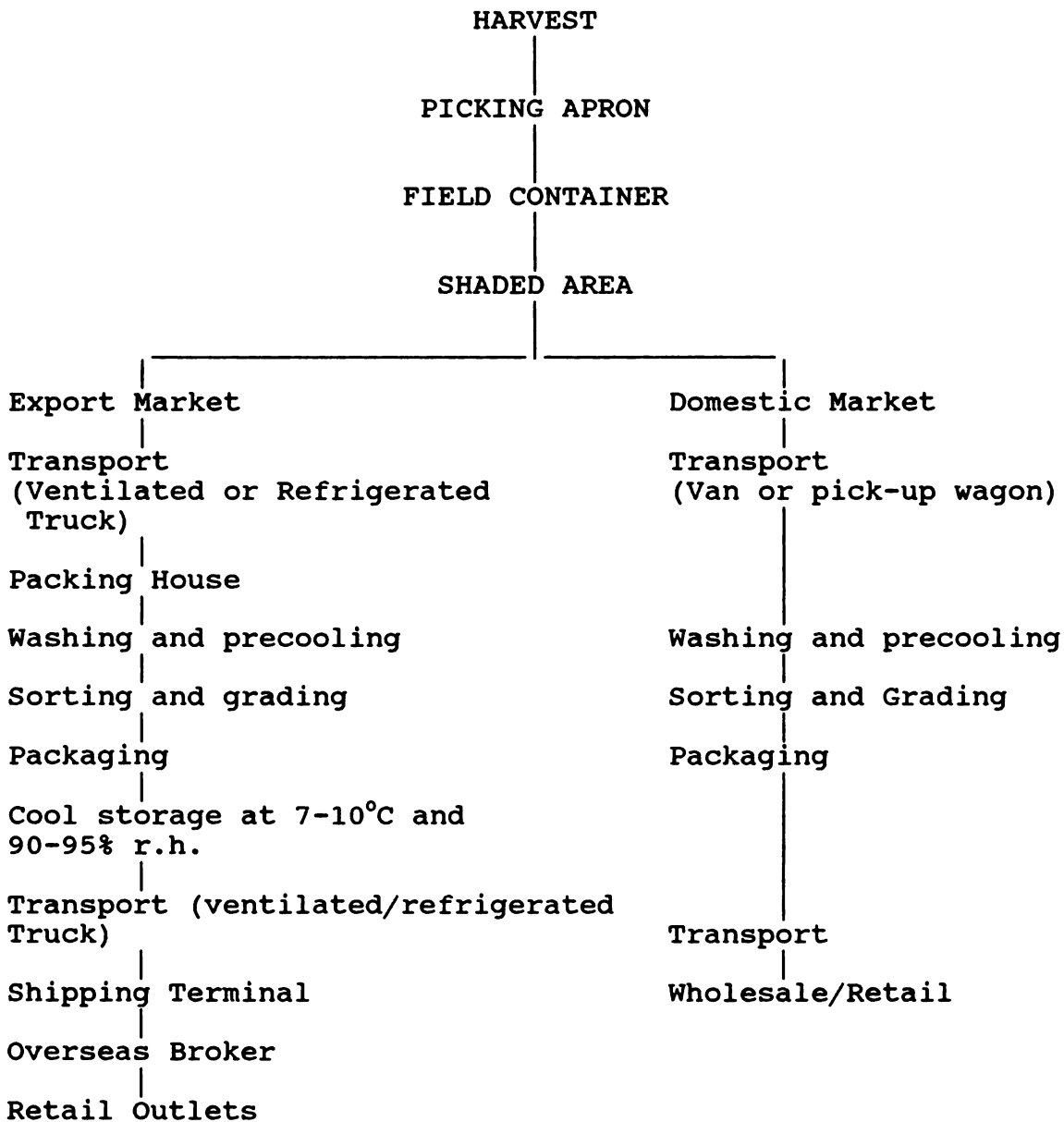
HANDLING SYSTEM - SWEET POTATO



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Figure 1: Typical Post Harvest Handling System for Vegetables e.g. Hot Peppers, Okra, Sweet Peppers, Melongene, etc.



POST HARVEST HANDLING SYSTEMS FOR VEGETABLES

by

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INTRODUCTION

A post harvest handling system may be defined as the process that a particular vegetable or fruit undergoes from the time it is harvested until the time it reaches the consumer. Usually the term 'post harvest handling system' refers to the specific handling system of a particular fruit or vegetable at a specific location. Although no two postharvest handling systems are exactly alike, the components that make up handling systems are basically the same for all fruits and vegetables (Figure 1). Generally, these components include harvesting, cleaning, sorting, grading, packaging, storing, wholesaling, retailing, and the transportation necessary to take the product from one point to the next. The performance of the system as a whole is improved by adjusting the various elements that make it up. The success of the system depends on how well it can be done.

The value of horticultural exports from Trinidad and Tobago has risen from \$2.7 million in 1986 to \$5.2 million in 1989. Vegetables alone comprised almost 46% of total exports in 1989, worth \$2.4 million (EDC Monthly Reports 1986-1989). This growth explosion presents great opportunities for Trinidad and Tobago exporters, but also great challenges. The challenges will be related to achieving profitability at all levels for the country, the growers and the exporters. The overall objective from a national point of view is clear: Trinidad and Tobago must place only top quality produce on international markets. The quality of our exports must be consistently better than that of our major competitors, as they will improve their quality, so must we take appropriate measures to ensure that we remain ahead. This must be achieved in the most economical way possible.

It has been estimated that as much as 50% of the cost of exporting crops to the eventual consumer is incurred after the crop leaves the farm gate. In addition the greatest losses occur in the post harvest phase of handling, packing, packaging, sorting, grading, storage and transport. These post harvest practices are an integral part of the export trade and, like production, it needs to be effectively managed. Post harvest management therefore, as related to the growing of fresh produce for export must be based on the management for quality. This requires an understanding of the nature of how the produce is distributed through the various channels in preparation for export, the produce itself, the

packaging, the environment, the transit time and of the interactions between these components.

Management of post harvest quality, which is characterised with the exporter acting as the middleman, also relies on the ability to predict changes in quality and to examine the distribution networks. The exporter therefore provides the means for market penetration from grower to consumer. From the point of harvest to consumption, perishable crops destined for export are subjected to environments which very often cause deterioration in quality. Thus post harvest management controls the availability and quality of the produce after it has left the farm. Many importers of perishable produce have commented on the poor quality, poor carriage conditions, excessive rotting, inadequate package designs and inconsistent supplies as major obstacles with the crops they receive.

Effective management of each component within a post harvest handling system is required so that the produce is delivered to the consumer in an acceptable condition at minimal cost. It begins with understanding the factors affecting produce quality. The management of such a complex system requires that all the various parts be seen and acted on, as belonging to a whole. Changes to one part to improve performance may not benefit the system overall. Imagine a farmer growing to export or growing for an exporter and has looked after a crop of hot peppers in the three to four months, invested considerable sums of money and picked and packed at the best time. He has even harvested during the coolest part of the day and ensured that fruits are not exposed to direct sun rays by covering with a damp cloth under a shady tree, often within three hours of harvest. The person transporting the fruits for him arrives with an open-tray truck, probably with an unsuitable suspension, loads produce onto a truck and then covers produce with a dark coloured tarpaulin. By the time the fruits arrive at the airport terminal the temperature has reached 25-30°C. Further delays and lack of adequate holding facilities at the airport further encourages heat build-up with internal fruit temperature reaching as high as 30-35°C. Despite being air freighted, the broker informs him afterwards of extensive fruit breakdown. All the initial good work is lost. This is an example of a breakdown of events in the post harvest system.

EFFECT OF ENVIRONMENT AND TIME ON QUALITY

From a management point of view it is important to appreciate that all fresh produce whether for domestic or foreign markets deteriorates with time. The deterioration process is irreversible. It begins at harvest and continues until the produce is consumed or it becomes unsaleable. As such post harvest management practices can only affect the rate at which the deterioration takes

place. The causes of deterioration are referred to as the 3P's and categorised as physical, pathological, physiological or a combination of all three. For example, physical damage may provide sites for pathological infection and hasten physiological decay processes. Deterioration of produce due to the principal factors noted above is and can be quantified as a function of time and environment.

TYPES OF DETERIORATION

a. Physical Deterioration

Physical damage is a major contributor to the deterioration of crops destined for export. Poor preharvest practices can reduce shelf-life by about one-third, but poor post harvest management can reduce shelf-life by two-thirds.

Physical damage to produce may be categorised as bruising, cracking and abrasion. The damage results from static and dynamic loads imposed on the produce throughout the distribution system during handling, transport and storage. It is characterised by cell bursting in bruising, separation of tissue along shear surfaces in slip, tearing apart in cracking and by surface scuffing in abrasion. Unlike most physiological and pathological deterioration, damage due to excessive loads can be considered instantaneous. When a box of okra or hot peppers for example is dropped, bruising or cell wall bursting occurs immediately although discolouration of the bruised tissue due to enzyme reactions may take some time. Bruising itself does not increase with elapsed time from the damaging event, although bruising may influence subsequent physiological or pathological decay.

Post harvest management of physical damage must be linked to each stage from harvest to consumption. For example, physical damage of produce due to transporting a load of produce must be aimed at implementing strategies such as controlling vehicle speed, vehicle suspension and alterations to road profile. Alternative handling practices can also be examined. It is not uncommon for packages to be dropped from 300mm or more during manual loading while the same package handled by a fork-lift may never suffer drops in excess of 30mm.

b. Pathological Deterioration

Pathological deterioration is also a continuous process. Once growth begins, the rate, like that of physiological decay, is a function of temperature and gas composition, with high temperatures promoting faster growth. Post harvest chemicals can be employed to prevent initial infection, destroy existing pathogens or slow down the growth rate.

Any post harvest management strategy to deal with pathological damage would need to establish first of all the conditions which initiate growth of the pathogen, eg. temperature, relative humidity, modified atmosphere, stage of maturity, chilling injury damage or physical damage. Also the conditions likely to promote disease development eg. availability of substrates due to ripening, availability of nutrients, pH, water status or conditions likely to retard disease development, eg. chemical barriers to pathogen development. Once the percentage damage due to pathological deterioration exceed standards, the produce is deemed inferior and post harvest management is concerned with taking action before this occurs such as proper field spraying and sanitation, post harvest dip treatments, proper grading and sorting and temperature and relative humidity regulation.

c. Physiological Deterioration

Softening change of colour, wilting injury and sunburn are all physiological changes that are directly influenced by the produce environment eg. temperature, relative humidity and gas composition. Gas composition has a profound effect on retardation of senescence of fruits and vegetables. Relative humidity controls the rate at which water is lost after harvest. Ethylene is intimately involved in fruit ripening and can cause serious disorders in leafy vegetables and flowers at concentrations of 0.05 - 10ppm (Ryall and Lipton 1972; Lutz and Hardenburg, 1968). For each commodity there is an upper temperature limit beyond which heat damage occurs and a lower limit below which chilling injury and freezing injury occurs. In the range between heat and chilling injury, the relationship between life span and temperature is of greatest concern in maintaining quality. Post harvest management of deterioration due to temperature is concerned with avoiding temperature sensitive limits and with assessing how much storage life remains.

The manager of a cooperative involved in exporting perishables or a grower or exporter can influence the occurrence and rate of the above-mentioned deterioration processes by controlling events and conditions. He can also control, within limits, the time spent in the handling of the produce from harvest to consumption. From that information, plus knowledge of supplies from the markets, prices can then be determined. The returns thus predicted, less the costs incurred at each component of the post harvest system, give the expected profit.

NATURE AND CAUSES OF DETERIORATION

a. Initial Produce Quality

It is important to note that the quality of produce as it initially enters the post harvest system has a significant impact on the quality of the produce leaving the system when marketed to consumers. Quality cannot be improved as the produce moves through the post harvest system. Deterioration, even under ideal conditions, is an inevitable continuing process. Thus a major objective of any post harvest management scheme must be to minimize quantity and quality losses in balance with the economic realities of the marketplace.

Although produce experience losses during each phase of the post harvest system, unless proper sorting and grading for prepacking takes place prior to export, losses occurring earlier due to harvesting produce at the incorrect stage of maturity and other handling defects may remain undiscovered until the produce reach the exporter or receiver.

b. Temperature and Humidity

The inadequacy of temperature and humidity is a problem prevalent throughout the post harvest system. Since most produce items have a narrow temperature tolerance range (10-15°C) it is a critical factor in quality maintenance. As a rule, the respiration rate of fresh produce doubles for approximately each 10°C in temperatures above 0°C. Hot peppers for example will retain high quality for 8 days at 10°C. However, when the temperature rises to 20°C, shelf life is reduced to a maximum of 4 days and is further reduced to 2 days if kept at ambient temperature 28-30°C (Mohammed 1988). Similarly, okra stored for 1 day at 28-30°C incur as much deterioration as in 6 days at 8-10°C. Table 1 shows the optimal holding temperatures for many perishables exported from Trinidad and Tobago.

The most direct effect of inadequate temperature and humidity conditions is the increased rate of moisture loss, causing weight reduction of the produce. Since produce is often sold by the pound or kilogram, weight loss may also cause losses of nutritional content, flavour and appearance. Losses of this kind that exceed 4% fresh weight losses in peppers, or melongene is the beginning of visible signs of shrivelling but where it exceeds 10%, severe wilting is evident.

Post harvest management to resolve the temperature problem based on the optimum conditions as depicted in Table 1 would aim to achieve.

1. reduction in aging due to ripening, softening, texture and colour changes
2. retardation of undesirable metabolic changes and respiratory heat production

Table 1: Recommended Temperature and Relative Humidity and Approximate Storage Life for Some Fresh Perishable Crops

COMMODITY	TEMPERATURE (°C)	RELATIVE HUMIDITY	APPROXIMATE STORAGE LIFE
Avocado: Lula	4.5	85 - 90	4 - 5 week
Pollock	10 - 13	85 - 90	2 weeks
Banana: Cavendish	13	85 - 90	10 - 20 days
Gros Michel	13	85 - 90	10 - 20 days
Lacatan	13 - 15	85 - 90	1 month
Beans (green)	4 - 7	95	5 - 7 days
Breadfruit	13	95	1 - 3 weeks
	8 - 12	90 - 95	1 week
Eggplants	13	65 - 70	6 months
Ginger	8 - 10	90 - 95	8 - 10 days
Hot Peppers	7 - 10	90 - 95	7 - 10 days
Okra	10	90	3 - 4 weeks
Papaya: Green	7	90	2 - 3 weeks
Turning	0	95 - 98	1 - 2 weeks
Peas (green)	10 - 13	50 - 70	2 - 3 months
Pumpkins	7 - 10	90 - 95	1 - 3 weeks
Sweet peppers	5 - 10	95	1 - 2 weeks
Squash	13 - 16	95 - 90	4 - 7 months
Sweet potatoes	13 - 21	90 - 95	1 - 3 weeks
Tomato: Mature	8 - 10	90 - 95	4 - 7 days
Green			
Ripe			

3. reduction in moisture loss and wilting
4. reduction in spoilage due to invasion by bacteria, fungi, etc.
5. reduction in undesirable growth such as sprouting in some root crops.

Exporters, storage operators and cooperative with chill room facilities should use temperature-time recorders to know the temperature variations experienced by produce as they move through the various handling stages in the post harvest system. Such monitoring of temperature and relative humidity will provide the information which could have the positive effect of reducing losses by increasing awareness of the exact situations under which temperature problems occur.

Another essential component of post harvest temperature and relative humidity management to maintain quality and to continue to achieve the benefits outlined above would be to pre-cool the produce in an effort to remove field heat and at the same time to reduce the refrigeration load on precooling equipment. However the success of precooling is dependent on:

1. time between harvest and precooling
2. type of shipping container if produce is packed before hand
3. initial product temperature
4. velocity or amount of cold air, water or ice provided
5. final produce temperature
6. sanitation of the precooling air or water to reduce decay organism
7. maintenance of the recommended temperature after precooling.

Table 2 outlines the types of precooling methods most suitable for different commodities exported from Trinidad and Tobago. Post harvest management of temperature does not necessarily mean that refrigeration is a must. Alternative precooling measures that producers and exporters can adopt in absence or precooling facilities are:-

1. Shading of produce under natural shade or under a shed.
2. Harvesting in early morning hours or during the night.

Table 2: Cooling Methods and Commodity Suitability

COOLING METHOD	COMMODITIES COOLED	COMMENTS
Room cooling	All commodities	Too slow for many perishable commodities. Varying cooling rates within loads, pallets and containers.
Forced air-cooling	Fruits, fruit-type vegetables, tubers, cut flowers	Faster than room cooling. Uniform cooling. Container venting and stacking requirements are critical to effective cooling.
Hydrocooling	Leafy vegetables, some fruits and fruit-type vegetables	Very fast cooling. Uniform cooling. Daily cleaning and sanitation needed. Produce must tolerate wetting. Containers for shipping must be water-tolerant.
Package-icing	Roots, some flower-type vegetables	Fast cooling. Limited to crops that can tolerate water-ice contact. Water tolerant shipping containers required.
Vacuum cooling	Leafy vegetables, some flower-type vegetables	Commodities must have a favourable surface-to-mass ratio for effective cooling. Equipment expensive. Water tolerant shipping container needed.
Transit cooling: Mechanical Refrigeration	All Commodities	Cooling in most available equipment is too slow and variable.
Top-icing and channel-icing	Some roots, leafy vegetables, cantaloupes	Slow and irregular. Water tolerant shipping containers needed.

3. Protecting harvested commodities from the sun with a light coloured and damp covering.

4. Keeping delays as short as possible.

c. Physical Handling

Improper handling is another damage-causing problem that occurs throughout all phases of the post harvest system. Abusive treatment of produce is due principally to a lack of training and supervision of personnel who are involved in the handling of fresh produce. They either fail to appreciate the fragile nature of the produce and the losses which result from rough treatment; or they simply do not act in accordance with this knowledge.

d. Packaging

Exporters must be aware that to obtain the best possible prices for their produce overseas the produce must be in top quality condition, and this can only be achieved by ensuring that the packaging not only protects the produce from damage, from external causes, but also provides a free flow of air, depending on whether the produce requires temperature control or constant airflow changes.

Size of packages is an important factor in the export sector. Foreign receivers complain that their retailers have limited display and storage space, and insist sales can be increased considerably with packages holding quantities that can be disposed of in a day or two. For example, shipping containers with quantities exceeding 18kg (40 lbs) are generally not preferred for many commodities, such as hot peppers and okra. However a 5-7 kg (10-15 lbs) package can eliminate the possibility of repacking in smaller size units and would satisfy most overseas marketing demands. In view of the number of times export produce packages are handled, in addition to the longer transit time, suggest that the exporter should select a package based on strength, resistance to moisture, inclusion of inner packing materials such as crosswise dividers, and panel inserts or special corner posts to increase compression strength.

The proper assembling and the adequate closing of packages are important factors in the delivery of accepted perishables and the development of satisfied receivers. In specific cases, poor practices, such as staples protruding through the walls of shipping containers can cause serious punctures and damage to the produce. More uniform sizing within a given package, consistent weights and exact counts, improved grade standards, and the use of standard packs and shipping containers by all exporters nationwide and other areas that concern foreign receivers.

Export packages or boxes for air freighted consignments of hot peppers, okra, melongene, ginger, etc. can present some problems. For example, if an exporter does not have a large enough consignment to fill an airline container then the boxes will be stowed in a 'pyramid fashion' on a pallet in order that they can be stowed to one side of the aircraft where the fuselage has a curve. To get the exact shape, the bottom layer of the boxes very often overlaps the pallet edge, and as a result the boxes will become damaged should the pallet come into contact with anything. This can cause a pyramid-effect collapse where the bottom boxes are severely crushed.

The best packaging in the world is of no use if the cargo is not stowed correctly. Refrigerated cargo containers equipped with airflow channels to allow cool air to reach all parts of the container would be ideal for perishables but unfortunately it may be some time before these become available at an economical cost to be used by exporters. In the meantime all the perishables exported from Trinidad and Tobago are shipped in un-refrigerated air containers. This, coupled with the unavailability of cold storage facilities at the airport and a general lack of coordination at the origin and destination airports to ensure produce quality when flights are delayed are hardly the best method to export perishable produce. The end result of these inadequacies could mean extensive post harvest losses with the exporter in danger of losing his overseas market. The importer overseas is in business like everyone else, meaning that the produce he gets must have enough remaining shelf life for marketing in order to make a profit on the resale of the produce. If it arrives damaged, he loses his profit, and if he sees that the cause of damage was through insufficiency of packaging or faulty stowage he will rightly seek his source of supply from elsewhere.

a. Transportation

When it is considered that the transportation phase may represent one half more of the harvester to importer time period, it can be appreciated that transportation has a substantial impact on produce quality management. Temperature at which the produce is held affects the rates of all biological processes, ie. respiration, ripening, moisture loss and development of decay-causing organisms. Proper in-transit temperatures not only are essential to maintain optimum quality until time of arrival at the destination, but also prolong market life.

A number of damages inflicted on produce during transportation can be packaging-related. For example,

1. Inadequate ventilation caused by containers can obstruct air flow around produce
2. Package side walls do not support reasonable stacking weights

3. Packages weakened by excessive moisture
4. Excessive weight and stress on packages due to improper stacking or loading methods
5. 'Under filling' and 'over filling' of packages can cause undue stress on lower layers of stacked boxes.

Another cause of produce losses during the transportation phase is excessive delivery time from field to packing shed over poor quality roads. Unpredictable delays and uncertain delivery schedules from grower to exporter packing house and from the latter to airport terminal increase the difficulty of developing standardized procedures for the proper care and handling of produce.

A major method in management of a post harvest handling system would be to identify measures that can be removed from the system from field preparation to the importer that would provide the framework of quality maintenance to be more cost-effective. Some of these are:

1. Reduce the number of times the produce is handled from the field to the importer because each handling merely adds to the already great risk of produce damage and deterioration.
2. Increase labour productivity throughout the post harvest system. This can be best achieved by motivating labour to be more productive and by refining techniques for work planning, scheduling and performance evaluation. Widespread use of proven post harvest techniques to determine the most efficient method of harvesting, packaging, sorting, grading, storage and transportation. Standards of performance should be examined as well as the profitability of each phase of the post harvest system purposely analyzed.
3. Improving utilization of the cubic capacity of transportation vehicles and storage facilities wherever available.
4. Availability of holding facilities at airport with cold storage facilities to accommodate produce particularly so during periods of unexpected delays, etc.
5. Utilisation of insulated or refrigerated air cargo containers for proper temperature and relative humidity control.
6. Minimization of produce deterioration by using post harvest dips to reduce decay and senescence. The use of packages with suitable ventilation to minimise rapid decay at the same time to control moisture loss.
7. Better trained and educated person working in the post harvest system.

POST HARVEST MANAGEMENT STRATEGIES

1. Export industry for perishables must learn to think and act as an industry and not as a series of autonomous elements. In the export sector there is a growing distrust among producers, exporters and also importers concerning quality requirements, consistency of supplies and very often a great effort is devoted trying to push off the cost responsibility on someone else. Further erosion of the profit potential can be the only result of this type of attitude.

Some way must be found to put it all together into an industry-wide approach to basic problems. Meetings like this are certainly a start in the right direction.

2. Good communications are essential. Development of better communication among the various segments of the export sector to cross fertilize the benefits of innovations and research findings in packaging, storage, transportation, post harvest treatments and harvesting methods to uplift the quality of produce exported.
3. Development of costing methods that are meaningful to the total post harvest system.
4. All in the export sector must be more concerned with problems such as environment, consumerism health hazards eg. pesticide residue on produce, etc. Without close cooperation between producer, handlers and exporters in the Export Sector and full knowledge about the crop and its perishable nature, risks can be a dominating factor in the export industry.
5. There is need for research and development to bring about improvements in the system, eg. basic research findings on senescence delaying chemicals for leafy vegetables or applied research eg. the design and testing of a harvesting apron or a sorting table.

CONCLUSION

Perishables destined for export market have large costs compared to those of production and it needs to be effectively managed. It needs as much emphasis as production. For perishables post harvest management of quality is of prime importance to attract and satisfy consumers. On the other hand, to ensure adequate returns, the cost of post harvest management or quality maintenance must be balanced against the reduction in value for lower quality produce. The basis for management of quality is prediction of damage resulting from the susceptibility of the produce to the hazards of distribution. Damage occurs in one or more ways and the recognition of the modes of failure for the components of the post harvest system in the Export Sector is essential to the prediction of damage.

Finally, the mastery of the 3 R's is an important aspect of our learning process towards effective management in a post harvest handling system. The 3 R's in the export business are **Respect** tender crops that are easily damaged; **Refrigerate** to curtail life processes, conserve quality, curtail dehydration and inhibit pathogens; **Rush** to ensure freshness and acceptance by a critical importer or consumer.

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POST HARVEST HANDLING AND STORAGE OF FRESH FRUITS

by

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INTRODUCTION

Preservation of fruits in the fresh state with minimum loss in quality during the handling and storage period primarily involves retardation of the physiological and biochemical changes associated with ripening and senescence. This principle is the basis for the commercial handling and storage of fruits, and hence the need for farmers, wholesalers, fruit packers and exporters to be familiar with post harvest behaviour.

The life of the fruit can be divided into four stages, viz:

- i. fruit growth and development
- ii. maturation
- iii. ripening
- iv. senescence

i. Fruit growth and development

This is characterised by rapid cell division. Cells enlarge and inter-cellular spaces are formed as the fruit increases in volume and weight. In the rapidly growing stage there is a high rate of metabolism and respiration is at its peak.

ii. Maturation

This stage is generally characterised by the loss of the green pigment chlorophyll in the skin and flesh an increase in sugars, a decrease in acidity and a decrease in starch content. For particular fruits certain characteristics determining maturation can be measured e.g. for citrus fruits the sugar/acid ratio is measured (10:1), for avocados the oil content is 8% by weight excluding the skin and seed, the firmness and colour of peaches and apples.

iii. Ripening

This is the terminal period of maturation and the fruit develops the flavours, texture and aroma that contributes to optimum eating quality. This would already have taken place with the fruit on the tree, however, certain fruits do not ripen properly on the tree and this may be due to

the action of ethylene as a ripening hormone. Ripening is characterised by the action of ethylene, as enzymes are used in the ripening process, but they will not act until sufficient ethylene is present.

iv. Senescence

This is defined as the period following fruit development during which growth has ceased and the process of aging replaces the changes of ripening.

RESPIRATION

When the storage of fresh fruits, vegetables, cut flowers and similar products are being considered it should be remembered that these commodities are alive and that they carry on within themselves processes characteristic of all living things. The most important of these processes is respiration, by which the oxygen of the air is combined with the carbon of the plant tissues, occurring chiefly in sugars to form various decomposition products and eventually carbon dioxide and water i.e



The oxidation of sugar in the process of respiration is much more complicated than the simple formula indicated. It involves the transformation of phosphate derivatives of sugar to 3 carbon pyruvic acid which is then oxidised to CO_2 and H_2O , involving a number of plant acids in a cyclical series known as the Krebs cycle.

The oxygen for the respiration reaction comes from the surrounding air. It diffuses into the fruit and is dissolved in the cell solution where the reaction takes place. The CO_2 formed increases the CO_2 content of the cell solution. The water formed becomes part of the cell wall. There is gaseous exchange between O_2 and CO_2 with the surrounding atmosphere, and if there is insufficient O_2 , products of incomplete combustion such as aldehydes and alcohols are formed, imparting abnormal flavours. This is called fermentation. To avoid this undesirable physiological process fruit must have enough O_2 for normal respiration.

The heat evolved by stored fruits in the respiratory process is called 'vital heat' and is expressed in Btu per tonne per day. Individual fruits vary in respiration rates and there are differences between cultivars and maturities, so it cannot be expected that the values are fixed. Respiration rates are also closely governed by temperature. For every 10°C rise in fruit temperature, respiration rates are roughly doubled or tripled.

Refrigeration is therefore of prime importance in retarding respiration as the faster a product respire and ripens the greater is the quantity of heat produced. Respiration may also be retarded by restricting the fruit's supply of oxygen, and this principle forms the basis for controlled and modified atmosphere storage.

Respiration rates of fruits are given over various temperature ranges in the Tables presented. Generally the storage life of fruits varies inversely with the rate of respiration i.e. fruits with high rates have short storage lives, whereas fruits with low rates have longer storage lives. For fruits in storage the heat given off by respiration, must be removed through refrigeration to maintain the appropriate storage temperature and therefore the respiratory heat evolution rates are used to determine refrigeration requirements.

TRANSPIRATION

Most fruits and vegetables contain between 80 and 95% water by weight; some of which may be lost by evaporation. This loss of water in the vapour state from living tissues is known as transpiration. Losses in fruit weight due to respiration are small compared to transpiration.

Water vapour, like other gases, moves from a region of high to a region of low concentration. The relative humidity of the internal atmosphere of nearly all fruits and vegetables are at least 99%, that of the surrounding atmosphere less. Plant products therefore transpire when there is a difference between the water vapour pressure of the internal atmosphere of the product and that of the surrounding atmosphere. As long as there is a difference, transpiration or evaporation will continue. This difference in the vapour pressure of the product and that of the surrounding air is called the 'vapour pressure deficit'.

Transpiration results in a less attractive produce due to wilting, poorer texture and lowered quality. It can be reduced in fruit storage by raising the relative humidity, by reducing air movements, by lowering the air temperature and by protective packaging. The optimum relative humidity for the storage of most horticultural crops is between 85 - 100%.

All fruits do not lose water at the same rate when stored under the same conditions. The greater the exposed surface per unit volume of fruit, the faster the rate of transpiration. The thickness and nature of the protective waxy coating on different fruits results in differences in water loss.

CHANGES OCCURRING IN FRUITS AFTER HARVEST

Fruits after harvest show marked changes with time. These changes, the rates of which are significantly affected by the storage temperature, can be classified as follows, viz:-

- i. Physical
- ii. Chemical
- iii. Sensory

Physical changes of importance which occur to fruits after harvest and in storage can be described as losses in weight, losses in volume or shrinkage, changes in specific gravity and decreases in fruit firmness.

Figures 1 to 4 illustrate the changes in physical characteristics of the Julie mango wrapped in tissue paper and stored at ambient (28°C), 14°C, 10°C and 6°C (Bissoon, 1989) for up to 6 weeks.

Weight Loss

The effect of storage temperature

In Figure 1, the weight loss of mangoes was significantly affected by storage time and temperatures, increasing with increased storage time and decreasing as the storage temperature was lowered.

Losses in weight of the stored Julie mango were estimated and shown in Table 1.

Table 1: WEIGHT LOSS PER WEEK OF JULIE MANGOES STORED UNDER AMBIENT AND REFRIGERATED CONDITIONS

Storage temperature, °C	% Weight loss/week
28 (ambient)	11.0
14	4.9
10	2.1
6	2.4

The effect of waxing and packaging

Weight losses of stored fruits can be considerably reduced, not only by lowering the fruit's temperature, but by waxing, packaging and controlled atmosphere storage. In a storage

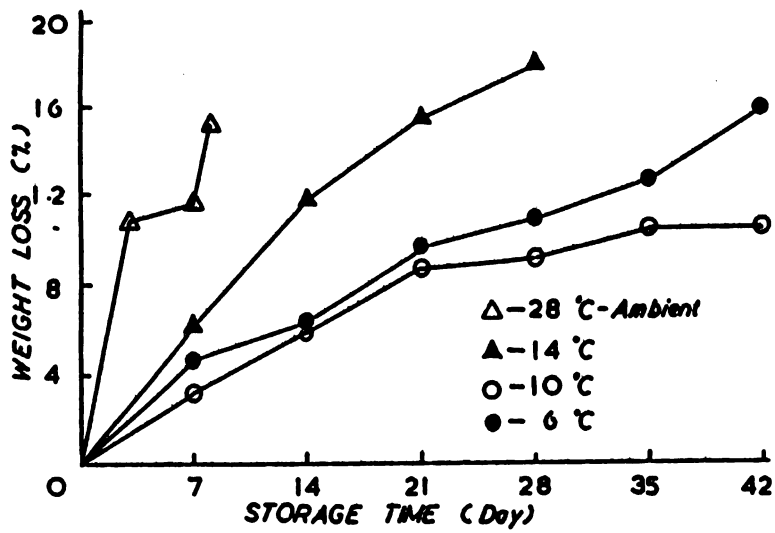


Figure 1: Weight loss of Julie Mangoes in storage

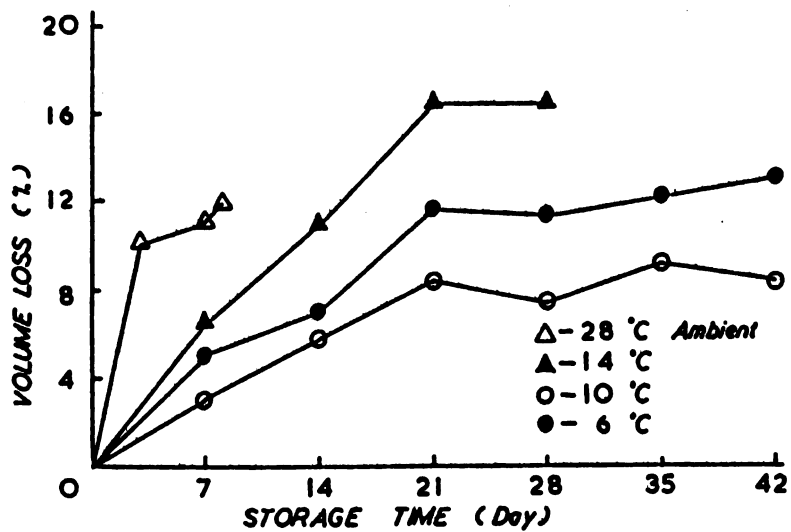


Figure 2: Volume loss of Julie Mangoes in storage

experiment lasting for a period up to 29 days at 16°C, papayas of the variety Tainung #1, were hot water/fungicide treated, some fruits were coated with a good grade 'Fresh Wax 51V' paste wax, some fruits were wrapped with a cling film produce wrap while others were stored under controlled atmosphere (CA) conditions of 2% O₂ and 5% CO₂ (Maharaj, 1988). While fruits under ambient conditions showed weight loss of 8.6%/week, which was reduced by about 50% through refrigerated storage, waxing, packaging and CA storage dramatically reduced such losses. These results are shown in Table 2.

Table 2: THE EFFECT OF WAXING, PACKAGING AND CA STORAGE ON THE WEIGHT LOSS OF PAPAYAS

Storage treatment	% weight loss/week
Ambient stored fruits, 28°C	8.6
* Refrigerated fruits only	4.5
Refrigerated + waxing	1.4
Refrigerated + packaging	0.8
Refrigerated + CA	0.6

* 16°C

Volume losses or shrinkage

The effect of storage temperature

Losses in fruit weight during storage principally through transpiration are accompanied by corresponding losses in volume. This results in shrinkage of the fruit, with a shrivelled, wrinkled, less attractive appearance.

Figure 2 shows the volume losses of Julie mangoes stored at the four temperatures, 28, 14, 10 and 6°C. Shrinkage was significantly affected by the storage temperature and storage time, increasing with time spent in storage and reducing as the storage temperature was lowered. Losses in volume or shrinkage of the stored fruits were estimated and are shown in Table 3 as:

**Table 3: VOLUME LOSS PER WEEK OF JULIE MANGOES STORED
UNDER AMBIENT & REFRIGERATED CONDITIONS**

Storage temperature, °C	% Volume loss/week
28 (ambient)	11.2
14	3.7
10	1.9
6	2.6

The effect of waxing and packaging

Waxing and packaging of fruits will reduce shrinkage or volume losses to the same extent to which weight losses are reduced.

Specific Gravity

The specific gravity of fruits has often been considered as an indicator of fruit maturity for harvest and in grading systems. It has been suggested for example, that mangoes with a s.g. of 1.01-1.02 are most suitable for harvest.

In the storage trial with Julie mangoes previously mentioned, the s.g. of fruits at harvest averaged 1.02, and this declined rapidly with time (Figure 3) to a value approaching 1.0 for fruits stored under ambient (28°C) conditions. The rapid reduction in s.g. is associated with fruit ripening, and this phenomena can be used to separate mature green fruits from ripe or ripening fruits in a sink/float water separation system.

Figure 3 also shows that when fruits are stored in refrigeration, the s.g. declines less rapidly, indicating that the ripening process is retarded.

Firmness

Fruits as they ripen become softer and increasingly subject to fungal attack. The control of fruit softening in storage can be achieved again through refrigeration as Figure 4 shows. In this example fruit firmness was measured by the depth of penetration of a cone into the fruit flesh. Increasing penetration depths therefore meant increasing softening. After 4 weeks in storage, Julie mangoes at 6 and 10°C remained as firm as freshly harvested fruits, demonstrating the delay

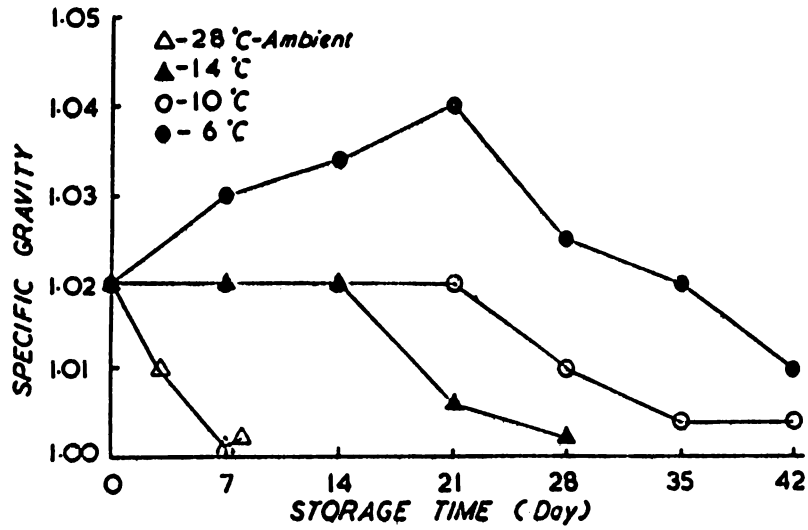


Figure 3: Specific gravity of Julie Mangoes in storage

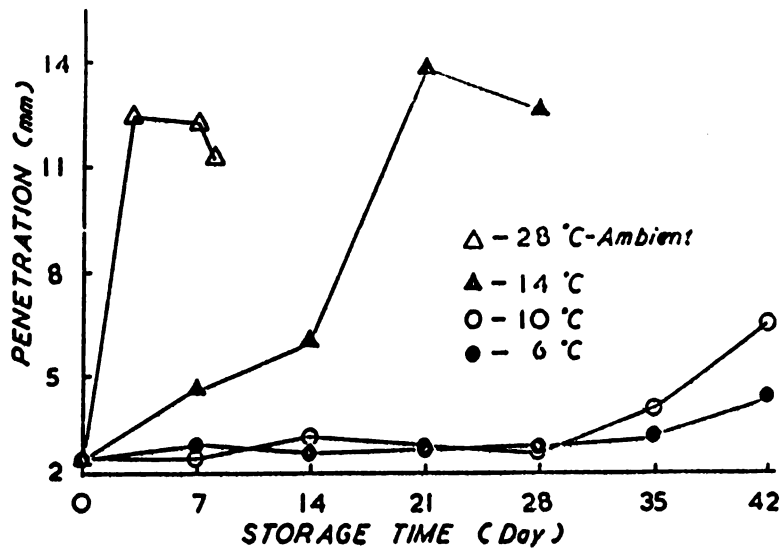


Figure 4: Firmness of Julie Mangoes in storage

in the ripening process at these low temperatures. Fruits stored at 14°C and particularly under ambient conditions (28°C) showed rapid reductions in firmness or softening.

Chemical Changes

Changes in the sugar and acid contents of fruits are used to determine fruit maturity for harvest purposes and to measure the ripeness of fruits for marketing. Often the sugar/acid ratio is used as a single indicator for maturity or ripeness.

Changes in the sugar, acid and sugar/acid ratios mature green Julie mangoes stored at 1, 10, 14 and 28°C are shown in Figures 5, 6 and 7.

Total soluble solids (TSS) given in Brix% and an index of the sugar content of the mango fruit was measured by a refractometer. As shown in Figure 5, TSS was reduced as storage temperatures were lowered, and increased with time for all treatments, indicating various degrees of ripening occurring in storage. It is noted however that for storage at 6°C, TSS values began increasing sharply only after 28 days in storage, suggesting a substantial delay in the ripening process.

Changes in acidity of fruits, as measured by % citric acid are shown in Figure 6. Under ambient conditions, stored Julie mangoes show a rapid fall in acidity, indicating that ripening occurs. However, as storage temperatures are reduced, acid levels fall less dramatically indicating that ripening is delayed through refrigeration.

The sugar acid ratio (S/A) as shown in figure 7 can also be used to measure maturity and ripening. Mature, green Julie mangoes suitable for storage show a S/A ratio of 2:3, while ripened fruits suitable consumption show a S/A ratio of 32:37. As expected Julie mangoes stored under ambient conditions showed rapid increases in the S/A ratio, indicating ripening occurring, whereas fruits stored in refrigeration showed less dramatic increases, particularly at 6 and 10°C, indicating a retardation of the ripening process (Figure 7).

PRODUCT QUALITY MANAGEMENT

Fruits intended for storage shipping and marketing should be as free as possible from skin breaks, bruises, decay and other defects. Bruises and other mechanical damage not only detract from the appearance of the product, but are also the principal avenues of entrance for decay organisms. Mechanical damage increases moisture loss. Products for storage should be neither immature not

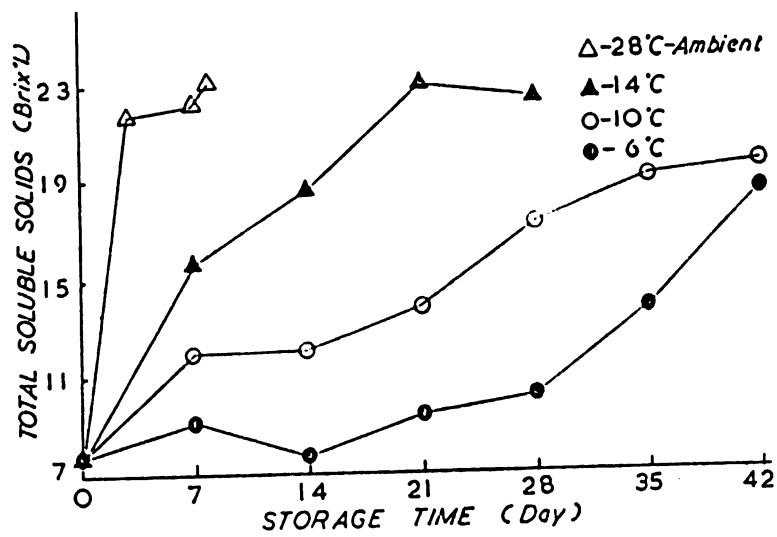


Figure 5: Soluble solids content of Julie Mangoes in storage

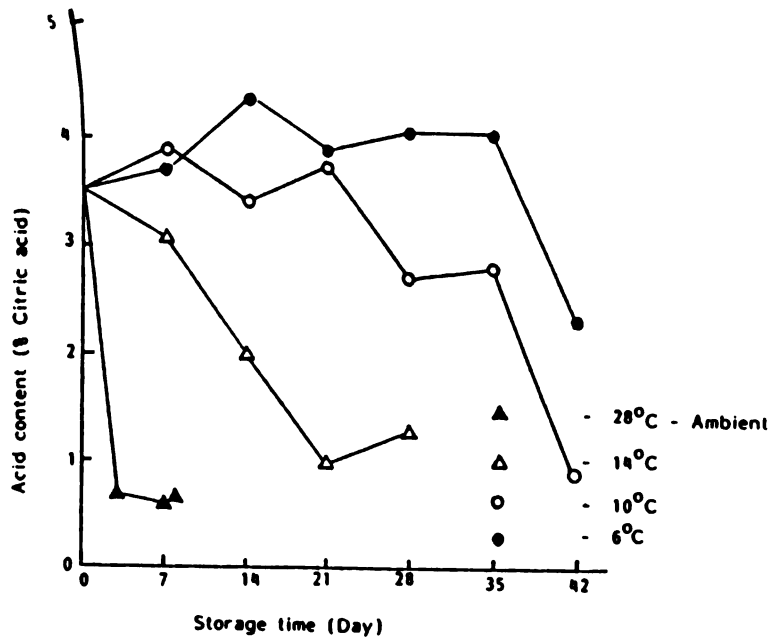


Figure 6: Acid content of Julie Mangoes in storage

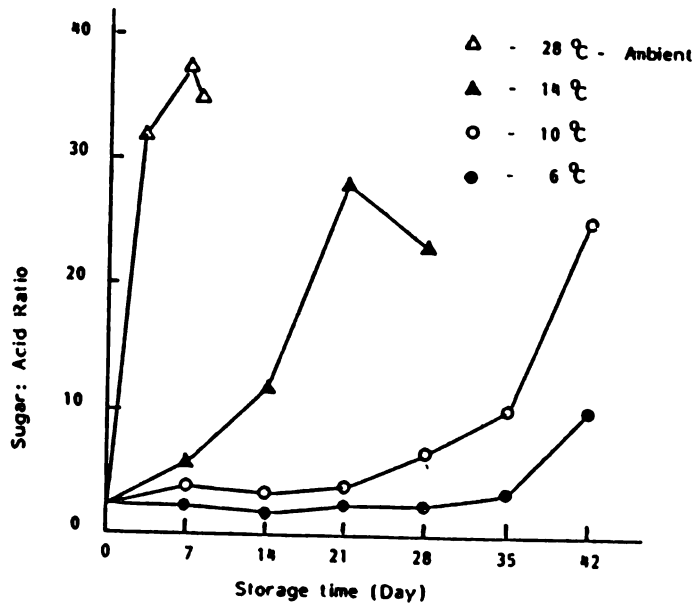


Figure 7: Sugar/acid ratios of Julie Mangoes in storage

over-mature because in either case storage life may be reduced. High quality produce of proper maturity stores best and longest. Different lots of fruits may vary greatly in their storage behaviour, being influenced by variety, climate, soil and cultural conditions, maturity and handling practices before storage. When crops are grown under unfavourable conditions, transported from a distance, delayed in storing or are deteriorated, appropriate allowance should be made in estimating their storage life.

Fruits of good quality destined for storage and export marketing can therefore be achieved through consideration of the following, viz:

- i. Fruit maturity at Harvest
- ii. Harvesting method
- iii. Transport from field to packing house

i. Fruit Maturity at Harvest

Fruits for storage/shipping should be harvested at the optimum stage of maturity, as storage life and quality may be reduced if they are immature or over-mature. As an example Table 4 describes certain characteristics to be used for harvesting fruits.

Table 4: MATURITY INDICES FOR HARVESTING CERTAIN TROPICAL FRUITS

Fruits	Index
Avocado	Fruits are full grown, with peel becoming glossy and smooth, with a yellowish tint to the skin and stem. An oil content with a minimum value of 8% is also used.
Banana	Harvested green and when fingers become near full or lose their distinct angularity.
Breadfruit	Large fruit size and segments, skin changing from deep green to a greenish/yellow colour.
Carambola	Skin colour changes from green to light yellow.
Jackfruit	Spines are widely spaced, will yield to finger pressure and when tapped should produce a dull, hollow sound. When odour is perceptible fruit is already ripe.

Fruits**Index**

Mango	Fruits at a mature green state with cheeks that are fully developed and which should sink in water. For the Julie mango, fruit shoulders are raised above point of stem insertion, flesh is yellowish-cream and later flow on picking is minimal.
Papaya	As soon as 10-15% yellow colour appears on the fruit surface
Pineapple	The eyes of individual fruit fills out, and the base of the fruit has changed from green to yellow or light brown.

Harvesting Methods

Crude methods of harvesting can injure the commodity and provide an entrance for micro-organisms which cause rotting. It also causes faster ripening which results in a short storage life. Fruits like avocado and mango should be harvested with a picking pole with a catching bag attached. A picking pole and hand catching may be employed for harvesting citrus, breadfruit and jackfruit. For medium sized trees e.g. the papaya, the use of a ladder is recommended. Care should therefore be taken to avoid fruits falling to the ground.

Transport

Improper field packaging and transport can lead to considerable mechanical injury to fruits destined for storage/shipping. Before transportation from field to packing house, some field sorting should be done e.g. ripe from unripe, damaged or injured from sound fruits.

Some tips for avoiding damage when transporting fruits are given in Appendix 1.

TEMPERATURE MANAGEMENT**Recommended Storage Temperatures**

As previously illustrated, refrigeration is the critical

element for successful post harvest storage of fruits, assuming other elements of the post harvest system have been appropriately managed i.e. harvesting, handling, sorting, cleaning, pre-treatments (fungicidal dips, waxing) and packaging.

Refrigerated storage is recommended for fruits and vegetables because it retards:

- i. respiration and other metabolic activity;
- ii. aging due to ripening, softening and textural and colour changes;
- iii. moisture loss and the wilting that results;
- iv. spoilage due to invasion by bacteria and fungi; and
- v. undesirable growth such as sprouting.

For best results the temperature in storage should be held fairly constant. Temperature variations can usually be prevented in well-insulated storage rooms with adequate refrigeration and if the spread between the temperature of the refrigerant and that of the room is kept small. Proper stacking and adequate air circulation also help to minimize temperature variation. Storage rooms should be equipped with reliable, accurate thermostats and their operation checked periodically.

The recommended cold storage conditions for certain fruits are given in Table 5 and tips on storing fruits given in Appendix 2.

Relative Humidity (RH)

The quality of fresh produce in storage depends to a great extent on the RH. RH is the amount of moisture in the air in relation to the amount it would carry if saturated at that temperature. RH is more difficult to control in the storage than the temperature and often does not receive adequate attention. If the air is too dry (low RH), water loss from produce may be sufficient to affect the texture, cause visible shrivelling or wilting and even make the produce unsaleable. If the RH is too high it may favour the development of decay. The control of mould becomes particularly difficult if the RH approaches 100 percent, which results in condensation of moisture. Surface mould may grow on walls, ceiling and containers as well as on stored products. Nevertheless, maintaining RH high enough is usually a greater problem than too high RH in commercial storage.

Pre-cooling

The greatest refrigeration load occurs when the storage is being filled with hot produce that must be cooled to the

required holding temperature. Once field heat has been removed, refrigeration requirements are greatly reduced and arise mainly from heat leakage into the storage and from heat of respiration. cold storage must be designed so that cooling can be accomplished rapidly while uniform holding temperatures are maintained in the remainder of the produce.

Table 5: RECOMMENDED COLD STORAGE CONDITIONS FOR CERTAIN FRUITS*

Fruit	Storage Temp., %	Relative Humidity, %
Avocado	13	85 - 90
Banana	13 - 14	85 - 90
Breadfruit	16	85 - 90
Carambola	9 - 10	85 - 90
Guava	9 - 10	85 - 90
Jackfruit	11 - 13	85 - 90
Limes	9 - 10	85 - 90
Mango	10	85 - 90
Oranges	7 - 9	85 - 90
Papaya	13 - 16	85 - 90
Passion Fruit	7 - 10	85 - 90
Pineapple	7 - 12	85 - 90

*Adapted from Hardenburg et. al. (1986), ASEAN-PHTRC Extension Bulletin #2 (1981), United Fresh Fruit and Vegetable Association - Fruit and Vegetable Facts and Pointers.

Alternatively, some form of pre-cooling must be used. Pre-cooling refers to the rapid removal of field heat before shipment or storage. The more quickly field heat is removed after harvest, the longer produce can be maintained in good marketable condition in storage.

Pre-cooling before storage is usually a separate operation requiring special facilities and equipment. Cooling with rapidly moving cold air in specially designed rooms or tunnels is one widely used method. The produce is stacked so as to provide maximum exposure to the air.

Hydrocooling, in which the produce is flooded with or immersed in cold water near 0°C is one of the most effective methods of pre-cooling. Contact icing or top icing is a pre-cooling method in which shaved or crushed ice is added to the top of the produce in a container or over the top of a load of produce in containers. This method is also used for produce in containers. This method is often used for produce being shipped by rail and road to cool the load in transit. Vacuum cooling is one of the most effective pre-cooling methods for leafy vegetables such as lettuce, spinach and celery.

Freezing and Chilling Injury

Injury from chilling should not be confused with that caused by freezing. Freezing damage is always associated with temperature below the freezing point of the produce. Various commodities have variable freezing points, usually just below 0°C.

Severe freezing usually results in general softening and discoloration of the tissues and the damage is readily apparent. Depending on the duration, moderate freezing may result in localized tissue injury, notably browning of the vascular elements, or it may not cause any apparent damage but will result in more rapid deterioration of the product. At the time of freezing the product usually has a glossy appearance, which in moderate freezing might be quite localized. Although produce that has been lightly or moderately frozen may appear normal when thawed, one should suspect that it will not store well or for a normal length of time. It should be marketed at the earliest opportunity. Fruits and vegetables should not be handled while frozen as the tissues are very sensitive to bruising.

Certain fruits and vegetables are injured by low (0° to 10°C) but non-freezing temperatures. At these temperatures they become weakened because they cannot carry on normal metabolic processes. Often products that are chilled look sound when removed from low temperatures. However, symptoms of chilling injury such as pitting or other skin blemishes, internal discoloration, or failure to ripen become evident in a few

days at a warmer temperature. Susceptible fruits that have been chilled may be particularly susceptible to decay. Many of the commodities susceptible to chilling injury are listed in Table 6 together with some of the symptoms.

Table 6: CHILLING INJURY OF CERTAIN SUSCEPTIBLE FRUITS*

Fruit	Approximate lowest safe temperature, °C	Character of Injury when stored between 0°C and safe temperature
Avocado	4.5 - 12.5	Greyish brown discoloration of flesh
Bananas	11.0 - 12.0	Dull colour and browning of the skin
Breadfruit	13.0	Severe browning of the skin
Carambola	5.0	Dull colour and browning of the skin
Mangoes (Julie)	10.0	Uneven ripening, little skin colour development S/A ratios low
Papayas	7.0	Failure to ripen, off flavours, decay
Pineapples	7.0	Dull green when ripened

* Adapted from Hardenburg et al (1986)

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APPENDIX 1

*TIPS IN AVOIDING DAMAGE WHEN TRANSPORTING COMMODITIES

1. Use containers that are strong enough to protect commodities considering the volume to be transported and distance to be travelled.

REASON: Strong packaging materials do not break easily thus protecting the produce from injuries during transport.

2. Packaging should be arranged to allow circulation of air between containers.

REASON: Air circulating freely around the surroundings of the commodity will prevent overheating and allow free gas exchange between the commodity and the environment.

3. If basket containers are used, line bottom and sides with newsprint, or other materials.

REASON: Liners serve as protection of produce against abrasion from sharp bottom and sides.

4. Insure that commodities are not underpacked or overpacked.

REASON: When underpacked, there will likely be more movement or jarring of commodities. When overpacked compression damages will likely occur.

5. Transport commodities preferable at dawn or at night when temperature is low.

REASON: Low temperature inhibits fast respiration and water loss of produce.

6. Make sure that vehicles to be used do not make jack-rabbit starts.

REASON: Jerks during vehicle start cause injury to the commodities.

7. Transport vehicles should have a good shock absorber or strong suspension relative to load.

REASON: This will minimize up and down movements of containers inside the vehicle.

8. Allow a space between cover/top of truck and the produce.

REASON: The space will allow proper ventilation for the produce.

9. Paint the canvass/roof of the truck white.

REASON: White reflects heat and therefore heat does not accumulate inside the truck inhibiting deterioration.

10. Pack in sizes that are easy to handle.

REASON: Manageable packs are easier to move, thus labourers can work faster.

11. Avoid using too deep containers.

REASON: Deep containers would contain more produce and those at the bottom will be more compressed, causing injury.

12. Load more fragile materials near centre of gravity of trucks.

REASON: Commodities near centre of trucks receive less injury than those at other parts.

*PHTRC (1981) - Circular #5

APPENDIX 2

* TIPS ON STORING FRUITS AND VEGETABLES

1. Store only good quality crops - clean, mature, free from disease and injury.

REASON: Diseased commodities may infect sound ones. Injured commodities are easily infected, lose water and heat fast, age rapidly. Immature ones do not have the potential for lasting long. Dirty commodities are sources of infection.

2. The sooner you store fruits and vegetables after harvest the longer is their storage life.

REASON: The produce will last only as their stored food or water last and as long as they can resist microbial attack. Store at low temperature immediately after harvest to slow down depletion of their reserves and microbial attack.

3. Make sure the storage container and room are clean.

REASON: They may harvest disease from previous

commodities.

4. Allow good circulation of air inside a store.

REASON: Cold air should circulate to be able to remove the heat given off by the commodities.

5. Do not mix fruits or vegetables of different kinds in one storeroom.

REASON: Some give off odours that can be picked up by other commodities. Some give off gases that are detrimental to other crops. Some last longer than others and in the process of deterioration may also shorten storage life.

6. Store ripe fruits separately from unripe ones.

REASON: Ripening or ripe fruits give off ethylene which hastens ripening of unripe fruits.

7. Use containers that can withstand stacking without getting deformed or without injuring commodity.

REASON: Injuries are minimized.

8. Store typically tropical produce at higher temperature (10°C or above) than those that originated from temperate countries (below 10°C).

REASON: Tropical crops break down at very low temperature.

9. Store leafy vegetable at a relatively more moist atmosphere (high relative humidity) than fruits.

REASON: A leafy vegetable has high moisture content and dry air draws out its moisture.

10. Store root and bulb crops at a relative drier atmosphere than either fruits or vegetables.

REASON: The root or sprout when the moisture in the atmosphere is high.

11. Keep root crops in a relatively moist environment that is not too warm for about two weeks before storage.

REASON: It hastens the healing of injuries.

12. Store only until such time when you can make a reasonable profit.

REASON: Storage is an added expense.

- 13 Practice care in putting in and removing products from storage.

REASON: Careless handling may result in injuries that could hasten deterioration.

14. Remove products from cold storage during the cool part of the day.

REASON: Removal during the hot part of the day results in 'sweating' of the commodity which provides a good environment for micro-organisms.

*PHTRC (1981) - Circular #2

POST-HARVEST PATHOLOGY OF FRUITS AND VEGETABLES

by

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INTRODUCTION

Considerable quantities of food leaving the farm gate never reach the consumer because of post-harvest deterioration problems which have been likened to a leaky pipeline (Figure 1). Efforts to increase agricultural production would be incomplete without decreasing losses along the chain linking the farmer with the final consumer. Against this background, post-harvest diseases can be defined as diseases that develop during harvesting, grading, packing, transportation to market, during storage and handling, etc. In other words, post-harvest diseases continue to develop until final consumption of the produce.

MAGNITUDE OF LOSSES

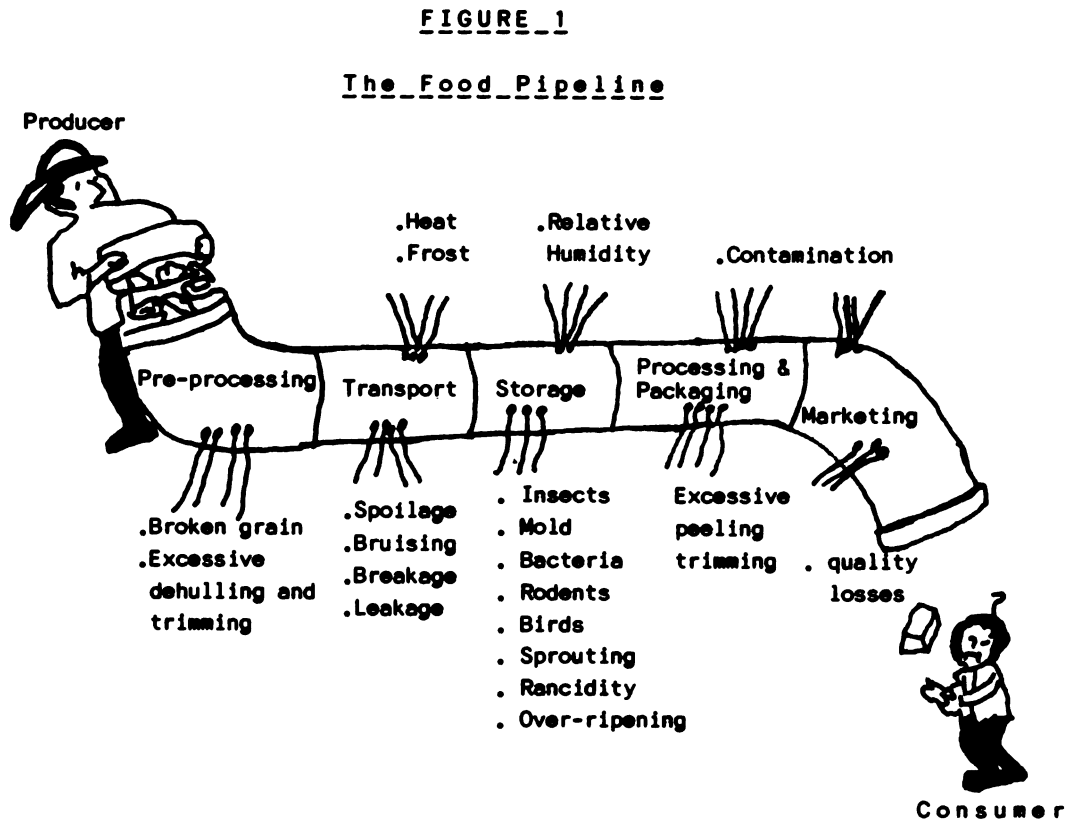
Post-harvest deterioration in fruits and vegetables causes significant losses particularly in developing countries, even though figures often quoted are 'guesstimates'. In general, losses are higher for highly perishable fruits and vegetables than for cereals and other field crops. Tables 1, 2 and 3 underscore the magnitude of post-harvest losses.

Table 1: Global Post-harvest Losses of Tropical Root Crops

Crop	Losses (%)
Sweet Potatoes	25
Cassava	25
Yams	25
Aroids	25

Source: Coursey and Booth (1972)

Figure 1: The Food Pipeline



**Source: M.C. Bourne (1987) LIFE NEWSLETTER (June/July '87)
(Life - League for International Food Education)**

Table 2: Post-harvest Losses in Selected Fruits and Vegetables Sampled at Wholesale, Retail and Consumer Markets in New York

Commodity	Loss at Indicated Markets			Total Loss* (%)
	Wholesale (%)	Retail (%)	Consumer (%)	
Cucumbers	-	5.0	2.9	7.9
Lettuce (Iceberg)	4.1	4.6	7.1	11.7
Peppers (Bell)	7.1	9.2	1.4	10.6
Strawberries	5.9	4.9	18.0	22.9
Sweet Potatoes	-	5.7	9.4	15.1
Tomatoes (Packaged)	-	6.3	7.9	14.2
Apples (Red Delicious)	0.2	0.2	1.5	1.7
Oranges (Valencia)	1.3	1.2	2.0	3.2

*Total includes retail and consumer losses only because no sorting is usually done at wholesale markets.

Source: J.M. Harvey (1978) Annu. Rev. Phytopathol 16: 321-341

Table 3: Post-harvest Losses in Latin America and the Caribbean

Commodity	Loss %
Tomatoes	37-70
Plantains	28-65
Cassava	40-75
Pineapple	40-50
Sweet Potatoes	50-55

Source: IICA Article in the Trinidad Guardian, June 2, 1990

Furthermore, a report by the National Academy of Sciences in the United States estimated post-harvest losses in 1976 in developing countries at 103 million tonnes, worth \$9.5 billion. The tragedy of these losses is that it represents not only economic loss but nutrient loss to peoples already under-nourished and those who can ill afford to stand such losses. The U.S. Report quoted above concluded that a 50% reduction in losses could drastically reduce or eliminate the large food import bill of many countries.

EFFECT OF POST-HARVEST DISEASES ON PRODUCE

Losses due to post-harvest diseases are usually direct in that they reduce quantity, quality (or both) of affected products. Post-harvest diseases may also result in the production by some infecting fungi of toxic substances called mycotoxins, some of which are known to be poisonous to humans or animals consuming products made of totally or partially infected grains or legumes. For example, aflatoxin (produced by Aspergillus flavus on peanuts) at concentrations of 1,000 ppb, causes death or serious illness in duckling and turkeys consuming such contaminated feed.

SYMPTOMS OF POST-HARVEST DISEASES

Many symptoms, including the following characterize post-harvest diseases:

1. Water-soaked tissues at first, then soft rot.
2. Loss of moisture and shrivelling.
3. Softened skin of produce ruptures during handling under pressure.
4. Dry rot.
5. Affected tissues give off mildly unpleasant smell or foul odour develops.
6. Discoloration of tissues, tissue breakdown, poor cooking quality.
7. Presence of fruiting bodies or other fungal structures, eg. mycelium, pycnidia, conidia, acervuli, etc.

CAUSES OF POST-HARVEST DETERIORATION

Post-harvest deterioration may be due to the following factors:

1. Physical: eg. Cracking caused by fluctuations in water supply and temperature; wounding, bruising, insect damage, rough handling; high and low temperature extremes, eg. chilling injury of sweet potatoes stored at 4°C.
2. Physiological and Biochemical: eg. Metabolic losses such as moisture loss, aging, ripening, senescence, respiratory losses, undesirable growth such as sprouting (RH and temperature influence these processes).
3. Pathological: Physical and physiological/biochemical factors often predispose commodities to post-harvest diseases which are caused by a relatively small number of fungi and bacteria (Table 4) compared with those attacking standing crops.

Table 4: Pathogens Associated with Post-harvest Losses

Fungi

Alternaria	Spp)	
Botrytis	Spp)	(will penetrate undamaged tissues)
Monilia	Spp)	
Penicillium	Spp)	
Phoma	Spp	
Phomopsis	Spp	
Rhizopus	Spp	

Bacteria

Erwinia	Spp
Pseudomonas	Spp

Most of these are weak or wound parasites that largely invade previously injured tissues or those affected by metabolic changes. A few fungi as shown above will, however, penetrate undamaged tissue.

There are several other factors that predispose produce to post-harvest pathogens. Very often, losses depend on the nature of the commodity as well as environmental conditions during storage. For example, it is accepted that the more tender and succulent the exterior of the produce, and the greater the water content of the entire commodity, the more susceptible that produce is to injury and infection by fungi and bacteria; eg. fleshy fruits and vegetables such as papaya and tomatoes. Rots developing at the blossom end of fruits usually involve prior colonizations of senescent floral parts at the end of blossoming. Such rotting in storage calls for field spraying. Other pathogen infections in storage result from contact infections under favourable environmental conditions (one bad apple spoils the barrel).

4. Combination of these factors: Table 5 shows the relative importance of these factors in post-harvest losses.

Table 5: Kinds of Post-harvest Losses in Selected Fruits and Vegetables in the New York Marketing Area

Commodity	Causes of Loss		
	Mechanical Injury (%)	Parasitic Disease (%)	Non-parasitic Disorder (%)
Cucumbers	1.2	3.3	3.4
Lettuce (Iceberg)	5.8	2.7	3.2
Peppers (Bell)	2.2	4.0	4.4
Strawberries	7.7	15.2	-
Sweet Potatoes	1.7	9.2	4.2
Tomatoes (Packaged)	2.5	10.7	0.9
Apples (Red Delicious)	1.8	0.5	1.3
Oranges (Valencia)	0.2	2.6	0.4

Source: J.M. Harvey (1978) Annu. Rev. Phytopathol. 16: 321-341

OBJECTIVES OF POST-HARVEST STORAGE

Storage is designed to prolong shelf life of produce. This objective is mostly achieved through some form of natural cooling

or refrigeration, calculated to retard for as long as possible, one or more of the following processes:

- a. Respiration and other metabolic losses.
- b. Aging as a result of ripening, softening, textural and colour changes.
- c. Moisture loss and the resulting wilting/shrinking.
- d. Direct spoilage as a result of growth of post-harvest pathogens.
- e. Undesirable growths such as sprouting in potatoes.

CONTROL OF POST-HARVEST DETERIORATION

Methods of reducing losses follow from the causes of the loss. In general, factors that reduce losses are similar to those that affect maintenance of overall quality. There are many traditional and advanced technologies for combatting post-harvest diseases; however, the transfer of modern technology in developing countries is often impractical due to high cost required to install and maintain the storage and handling facilities. To be successful, such technologies must be technically sound, economically justifiable and socially acceptable. The following methods are generally used for controlling post-harvest deterioration.

1. Careful Handling and Protective Packaging

The extent of post-harvest losses due to mechanical injury attest to the need for protective packaging and improved systems of handling fresh fruits and vegetables. Cuts and bruises increase water loss and admit pathogens and also reduce quality. Use of trays, packs, liners, plastic bags and covers reduce such damage. Proper loading patterns both in store and in transit, permit rapid air circulation and removal of gases such as ethylene which often hastens ripening. One loss reducing technology that has world-wide application for fruit and vegetable packaging is 'shrink wrapping', a technique to wrap produce individually using low cost plastic shrink films. This material reduces respiration, shrinkage and weight loss without any adverse effects on flavour. Shrink films double or triple shelf life of fruits and vegetables without refrigeration. The shrink wrap technology also prevents post-harvest diseases because it offers possibilities to impregnate chemicals in the film

rather than the product, thereby overcoming the objection of chemical residues on food. For example, Imazalil-impregnated films have successfully controlled Alternaria in Bell Peppers. The versatility and the numerous advantages of the shrink wrap technology have great potential for fruit and vegetable marketing.

Inducing Wound Barriers

Maintaining fruits at high vitality enhances their natural disease resistance and ability to heal wounds. For several root and tuber crops, wound healing, tuberization and periderm formation inhibit fungal invasion. Table 6 outlines the temperature and relative humidity requirements to achieve that objective.

Table 6: Conditions Required for Curing Root Crops

Crop	Temperature (°C)	Relative Humidity (%)	Time (Days)
Solanum Potatoes	15-21	80-95	10-14
Cassava	30-35	80-95	4-7
Sweet Potatoes	30-32	80-90	4-7
Yams	32-40	90-95	1-4
Aroids	Not yet determined		

Source: PANS Manual #4 - Centre for Overseas Pest Research, London.

3. Modified Atmospheres

Use of controlled atmosphere stores involves decreasing oxygen to 2-3% while carbon dioxide concentration is increased to 1-5%. This reduces respiration rate thereby delaying ripening, physiological deterioration, and growth of bacteria and fungi. Carbon dioxide concentrations of more than 10% retard growth of most pathogens and in practice, this is accomplished by placing solid carbon dioxide (dry ice) in transit boxes. This technology is being used for apples,

strawberries and occasionally for long distance transport of lettuce (using 2% CO₂) in the United States.

4. Hypobaric Storage

Storage and transport under low barometric pressures involves use of vacuum pumps and regulated flow of air in transport vans. The principle involved is that at low pressures of 50-100 mm Mercury, the amount of available oxygen is lowered from 21% at atmospheric pressure to about 1.4 to 2.8% respectively; such reduced pressures have retarded ripening in green tomatoes for example and inhibited decay in strawberries. The suppressive effects of reduced pressures are similar to controlled atmospheres at equivalent oxygen.

5. Manipulation of Relative Humidity (RH)

RH at 90% and above prevents desiccation and loss of weight irrespective of temperature. Plastic liners, etc., are used to maintain high RH. Decay due to raised RH occurs above 95% RH and results from condensation on produce surfaces. Weight loss often predisposes produce to pathogens. With jacketed storage or packages with moisture barriers of plastic film, high RH might promote disease if temperatures were favourable. Disease would likely increase if produce were wet when packaged.

6. Temperature Management

Perhaps the most critical factor in managing post-harvest diseases is temperature. For this reason, other control methods are often considered as supplements to refrigeration. Low temperatures slow fungal development, but the lowest temperatures tolerated by the commodity also maximizes its physiological post-harvest life.

In spite of its relative importance, temperature management is the most poorly done because of inadequate facilities or the poor understanding of its management by handlers.

Temperature management involves 2 steps:

- a. Cooling or removing field heat accomplished by cold air (forced air cooling) or cold water (hydrocooling) and lowering the temperature of the commodity to its storage temperature.

- b. Maintaining the low temperature by removing the heat of respiration.

Commodities differ in their urgency for prompt and rapid cooling. For example, papayas, mangoes, guavas, pineapples have an intermediate urgency for cooling compared with extra perishables, eg. strawberries, which have the greatest urgency. Bananas and citrus have the least urgency for rapid cooling.

Associated with temperature management, is chilling sensitivity of produce and each product's requirement must be taken into account. Chilling injury predisposes commodities to pathogens.

Heat Treatment

Hot, humid air or hot water also finds application in post-harvest control. Dips in water at 54°C for 2 1/2 minutes destroys surface pathogens and those beneath the skin of the produce - such as Rhizopus. Hot water treatments are faster and cause less injury than hot air because temperature rise is localized to the surface of the produce. Addition of fungicides to hot water permits a reduction in temperature and the amount of chemical required is less than that required at normal temperatures to control pathogens.

For example, Mangoes are treated for five minutes in a 55°C water bath to which 500 ppm Benomyl has been added. Similarly, Papayas are treated with a hot water spray of 54°C for three minutes with or without fungicide dips of 500 mg/l Benomyl or Thiabendazole.

7. Application of Chemicals after Harvest

When a controlled environment storage facility is unavailable or unaffordable, antimicrobial treatment may be the only means of extending the post harvest life of a perishable crop.

The use of post-harvest chemicals is considered secondary to other control strategies. The chemicals are required to prevent infection and to suppress pathogens, latent infections or those that develop at storage or below storage temperatures of the commodities. Frequently, pre-harvest chemical application is a more efficient means of controlling post-harvest pathogens, eg. Rhizopus spp on fruit. for mango anthracnose, hot water/benlate treatment is supplementary to pre-harvest sprays.

A limitation in the use of post-harvest chemicals is that of residue levels and food additive legislation or control. In spite of these reservations, several broad spectrum and systemic fungicides are widely used (See Table 7).

Table 7: Post-harvest Fungicides

Dichloran
Sodium O-Phenylphenate
Borax) Broad spectrum compounds active against Wound
Pathogens
Sodium Carbonate
Biphenyl

Benomyl
Thiabendazole
Thiophanate methyl) Systemics (1960's)
Carbendazim
Metaloxyl

Imazalil
Etaconazole) Ergosterol Biosynthesis inhibitors
Propiconazole (1970's)
Prochloraz

The following criteria influence the choice of post-harvest chemicals:

- a. Long residual activity
- b. Phytotoxicity should not be a problem
- c. No scalding action by the material
- d. tolerance/resistance by pathogens to the chemicals
- e. Residue level and food additive legislation
- f. Sensitivity of pathogen to the chemical agent
- g. Ability of agents to penetrate through surface barriers of the host to the infection site.

For example chemicals cleared for use in the UK on stored vegetables include benomyl, dichloran, dichlorephen and thiabendazole. Banana importing countries approve for post-harvest use the fungicide Imazalil.

General Sanitation

Strict cleanliness in handling produce for storage and transit will reduce losses caused by decay. Careful removal of rotten produce avoids spread by removing sources of inoculum, eg. Cleaning of boxes with calcium hypochlorite.

8. Biological Control

It could be defined as the use of one micro-organism to control another. Biological control is being developed for the future as an alternative approach to controlling post-harvest diseases because of the growing concern over pesticide use. For example, ethylene dibromide contamination has heightened public awareness of pesticide residues in our food with the result that more restrictions may be placed on the use of pesticides on harvested food. Secondly, fungicides have recently come under scrutiny as posing potential oncogenic risks when applied to processed food. This review by the Environment Protection Agency (EPA) of the United States could lead to the withdrawal of post-harvest fungicides. Alternatives must be made available if such fungicides are withdrawn. Fungicide resistance arising from the prolonged use/abuse of systemic fungicides also adds to the urgent need for more and new effective means of combatting post-harvest diseases. Despite the successes shown on Table 8, much remains to be done to make biological control commercially available. New approaches to biological control would include use of natural plant products and genetically engineered microbial antagonists.

Table 8: Successful Biocontrol of Post-harvest Diseases

CROP	DISEASE	ANTAGONISTS
Citrus	Green Mould	<u>Trichoderma</u> Sp
Pineapple	Penicillium rot	Attenuated strains of <u>penicillium</u> Sp
Potato	Softrot	<u>Pseudomonas putida</u>
Stone fruits	Brownrot	<u>Bacillus Subtilis</u>

Source: Wilson and Pussey (1985)

SUMMARY SHEET ON CONTROL OF SOME POST-HARVEST DISEASES

CROP DISEASE	CASUAL AGENT	CONTROL
Mango Anthracnose	<u>Colletotrichum gloeosporioides</u>	<p>Regular scheduled field sprays with fungicides.</p> <p>Post-harvest fruit dip in hot water 55°C for 5 minutes in which 500 ppm benomyl has been added. This treatment eradicates latent infections.</p>
Papaya Anthracnose	<u>Colletotrichum gloeosporioides</u>	<p>Harvested fruit when mature green can store at 10-12°C for 2-3 weeks.</p> <p>If resistance to the fungus develops, use imazalil and etaconazole.</p> <p>Storage temperature is 10°C.</p> <p>Sanitation in packing houses.</p> <p>Disinfect containers with NaOCl.</p>
		<p><u>Pre-harvest:</u> Protective sprays with fungicides eg. Mancozeb or chlorothalonil beginning at first fruit set.</p>
		<p><u>Post-harvest:</u> Hot water immersion or spray followed by application of fungicides in wax. Initially</p>

CROP DISEASE	CASUAL AGENT	CONTROL
		immerse fruit in 42°C water for 30 minutes followed by a 20 minute immersion at 40°C.
		Benlate/Thiabendazole applied at 4-8 g/l with wax is recommended.
Banana Crown Rot	Several fungi including: <u>Fusarium</u> <u>Cephalosporium</u> <u>Verticillium</u> <u>Botryodiplodia</u> <u>Colletotrichum</u> <u>Ceratocystis</u>	Spray or dip treatments of detached hands with 200-1000 mg/l Thiabendazole or 100-500 mg/l Benomyl.
		Controlled atmospheres (2-3% O ₂) - 5-7% CO ₂ .
		Ship fungicide treated produce in sealed polyethylene bags at ambient temperatures to delay ripening.
		Chlorination of fruit wash water (1ppm).
		Harvest to refrigeration intervals of less than 48 hours.
		Proper crown trimming procedures to allow clean cuts.
		Field sanitation to remove trash and fruit bagging.
Pineapple Black Rot	<u>Ceratocystis paradoxa</u>	Stores at 7°C for 10-20 days.

CROP DISEASE

CASUAL AGENT

CONTROL

Harvest when surface colour is between 'colour break' and quarter yellow depending on expected transit to market.

Post-harvest application of wax controls internal browning and water loss from fruit.

Use Thiabendazole or Benomyl in wax formulation or water before application to fruit or cut stem end.

Refrigerate fruits rapidly at 8°C.

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CROP	MAJOR POST-HARVEST PATHOGENS OF VEGETABLES	CONTROL
Celery	<u>Botrytis cinerea</u> <u>Sclerotinia Sclerotiorum</u> <u>Erwinia sp</u>	Dipping in 10 ppm Gibberellic acid to delay yellowing of leaflet and petioles, and to reduce rot by <u>Erwinia</u> and <u>Sclerotinia</u> .
Cauliflower	Flower bud tissue is susceptible to <u>Alternaria</u> spp, <u>Botrytis cinerea</u> <u>Peronospora parasitica</u> <u>Erwinia</u> sp <u>Pseudomonas</u> sp	Dip or drench in benomyl before storage. Stores at 0-2°C and 95% RH for 6-8 weeks.
Melons, Cucumbers, Eggplant, Squash and Peppers	Several post-harvest pathogens including <u>Fusarium</u> , <u>Rhizopus</u> and <u>Cladosporium</u>	Controlled atmosphere storage may be the most beneficial because no effective harvest chemical treatment has been reported. Stores at 0°C and 95% RH for up to 6 weeks.
Carrots	<u>Botrytis cinerea</u> <u>Erwinia</u> spp	Treat with coating formulation of 2.5% 0-phenylphenol to reduce shrinkage and decay. Dip in benomyl or Carbendazin. Apply 0-phenylphenol and benomyl in solvent wax formulation. Spray with benomyl or thiophanate methyl before harvest.

CROP

MAJOR POST-HARVEST PATHOGENS OF
VEGETABLES

CONTROL

Chlorination (25ppm) of wash water and prepackage in polyethylene film.

Post-harvest dip with benlate 250-500 mg/ml.

Store at 0°C and 98% RH. (Will store for 8-10 months).

Seed treatment with benomyl and thiram.

Bulbs should be forced air-dried before storage at 0°C and 65-70% RH.

Pre-harvest spray with Benlate and Thiabendazole reduce Botrytis decay.

Or use PCNB, dichloran and Thiabendazole as dusts.

Use benomyl and iprodione to control Alternaria.

Smoke the vinclozolin controls both Botrytis and Alternaria.

Stores for 8-10 months at 0-1°C and 95% RH.

Botrytis cinerea (neck rot)

Onions

Alternaria brassicicola (leaf spot)
Botrytis infection of outer leaves and cut base of petioles
Pseudomonas and Erwinia soft rot of heads (wet or frozen)

Cabbage

CROP	MAJOR POST-HARVEST PATHOGENS OF VEGETABLES	CONTROL
Tomato	<u>Rhizopus stolonifer</u> <u>Mucor mucedo</u> <u>Pseudomonas marginalis</u> <u>Botrytis cinerea</u> <u>Alternaria alternata</u> <u>Phytophthora parasitica</u> <u>Erwinia carotovora</u>	<p>Field sprays to protect flowers, fruitlets and stems.</p> <p>Chlorinated water treatment (100 ppm).</p> <p>Fungicides in wax formulation.</p> <p>Use Imazalil and etaconazole to control fungi resistant to the systemic fungicides.</p>

RELATIVE RESPIRATION RATES OF THE HARVESTED PORTION OF FRESH VEGETABLES

RELATIVE RATE OF RESPIRATION

VERY HIGH	HIGH	MODERATE	LOW	VERY LOW
Corn	Bean	Carrot	Cabbage	Onion
Spanish	Lettuce	Celery	Sweet Potato	Potato
Broccoli	Lima Bean	Cucumber	Turnip	
Pea		Pepper		
		Tomato		

* The higher the rate of respiration, the greater the amount of heat produced and the greater the amount of refrigeration needed to dissipate such heat. In general, the vegetables that have the lowest rates of respiration have the longest storage or shelf life after harvest.

Source: Oscar Lorenz and Donald Maynard (1980): Knott's Handbook for Vegetable Growers 2nd Edition.

CONTROLLING POST-HARVEST DISEASES CAUSED BY BACTERIA

The current strategy involves destruction of inoculum and making environment and host unfavourable for disease development. Opportunities for eradicating bacteria after infection are limited because bacteria multiply rapidly and few bactericides can penetrate in an active form to the injection site without damaging healthy tissue.

However, use of chlorine (50-100 ppm) in packing houses to wash, hydrocool and transport fresh fruits and vegetables is becoming popular. The chlorine treatment supposedly kills bacteria in water and on the surface of produce. It also prevents contamination of commodities, but it has little effect on bacteria found in niches such as stomata, lenticels and wounded tissue. In one research study, chlorine at 1000 ppm reduced soft rot in tomatoes caused by Erwinia carotovora by 82%.

The use of medically important antibiotics to control bacterial plant diseases should be done cautiously because of concerns that extra-chromosomal genetic elements for antibiotic resistance could be selected in plant pathogenic bacteria by exposure to these agents and these heredity factors might be transferred by conjugation to human pathogenic bacteria.

Two (2) bactericides approved for use in the UK include dichlorephen and iodophor, while sodium -o- phenylphenate (sopp) which has some bactericidal properties has been registered for use to kill Xanthomonas campestris pv. citri (citrus canker) on harvested fruit in Florida.

A novel synthetic bactericide (CGA 78039) developed for fireblight control inhibited soft rot of carrot and potatoes.

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CONDITIONS FOR EXPORT OF FRESH PINEAPPLE

by

Alain Pinon, Fruit and Citrus Institute (IFRA)
International Cooperation Centre for
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For export the quality of the fruit is a prime necessity. This quality is elaborated all along the growth of the plant and during the period of fruit development that means from the planting to the harvest of the fruit.

The quality is estimated at harvest time and must be preserved during transport until the sale of the fruit. At this time the consumer is the unique and ultimate judge. For buying the fruit, he only takes care of its external aspect. Later on other criteria are taken into account: taste, flesh aspect, flavour and the consumer always makes the decision between the external aspect of the fruit and its internal characteristics.

To reach this objective of a premium quality for the fruit it is indispensable to have:

- a homogenous field at forcing time
- a regular growth of the plant during its vegetative cycle (adequate fertilization, good control of pests, diseases and weeds, etc.)
- an excellent response to flowering induction treatment (no less than 95%)
- take care of the fruit from flowering induction to the sale of the fruit on a market.

In our presentation we will only examine the ultimate point which is extremely important but very often neglected.

PREPARATION OF THE FRUIT

After flower induction the pineapple grower must give it's attention to the developing fruit.

Crown reduction is for two main reasons: improving the aspect of the fruit and reducing weight and volume to reduce the cost of transport.

Protection against sun burn: sun burn can have serious consequences particularly when the fruit is lodged and protection implies shading the fruit during the last 4 to 6 weeks before harvest. The most common way to assure this protection is to tie strings length-wise down each side of the row and join them

together by crossing strings every 2 meters. In this case the fruits are also prevented from lodging.

For some years a treatment has often been applied with Etephon (Ethrel) to shorten the harvest period and to homogenize the fruit shell colour. In fact if the flowering treatment synchronizes the differentiation in all plants treated, all the fruits in one plot do not reach the same stage of ripeness at the same time. This is due to difference in weight: big fruits are harvested in a shorter period. But this treatment must be used with precaution. If pineapples are to be ethrelled it is important to wait for the first natural colour break on a plot to prevent application on unripe fruits which would result in yellow pineapples with low sugar content of a green fruit. The treatment is carried out only after the biggest fruits are harvested that means after 5 to 8% of the first fruits are harvested. This is the only case in which the fruit quality is not affected.

HARVESTING

Fruits for fresh fruit market have to be:

- harvested at the optimum stage of development (ripeness) required for a premium quality. The fruits should be harvested as nearly ripe as possible depending on the distance of the market (local or foreign market).
- handled with extreme care due to the fragility of the fruit. This fragility varies considerably from one cultivar to another. In the case of cayenne cultivars special care have to be taken to prevent damages because these fruits have an extremely fragile flesh and are very susceptible to bruising.

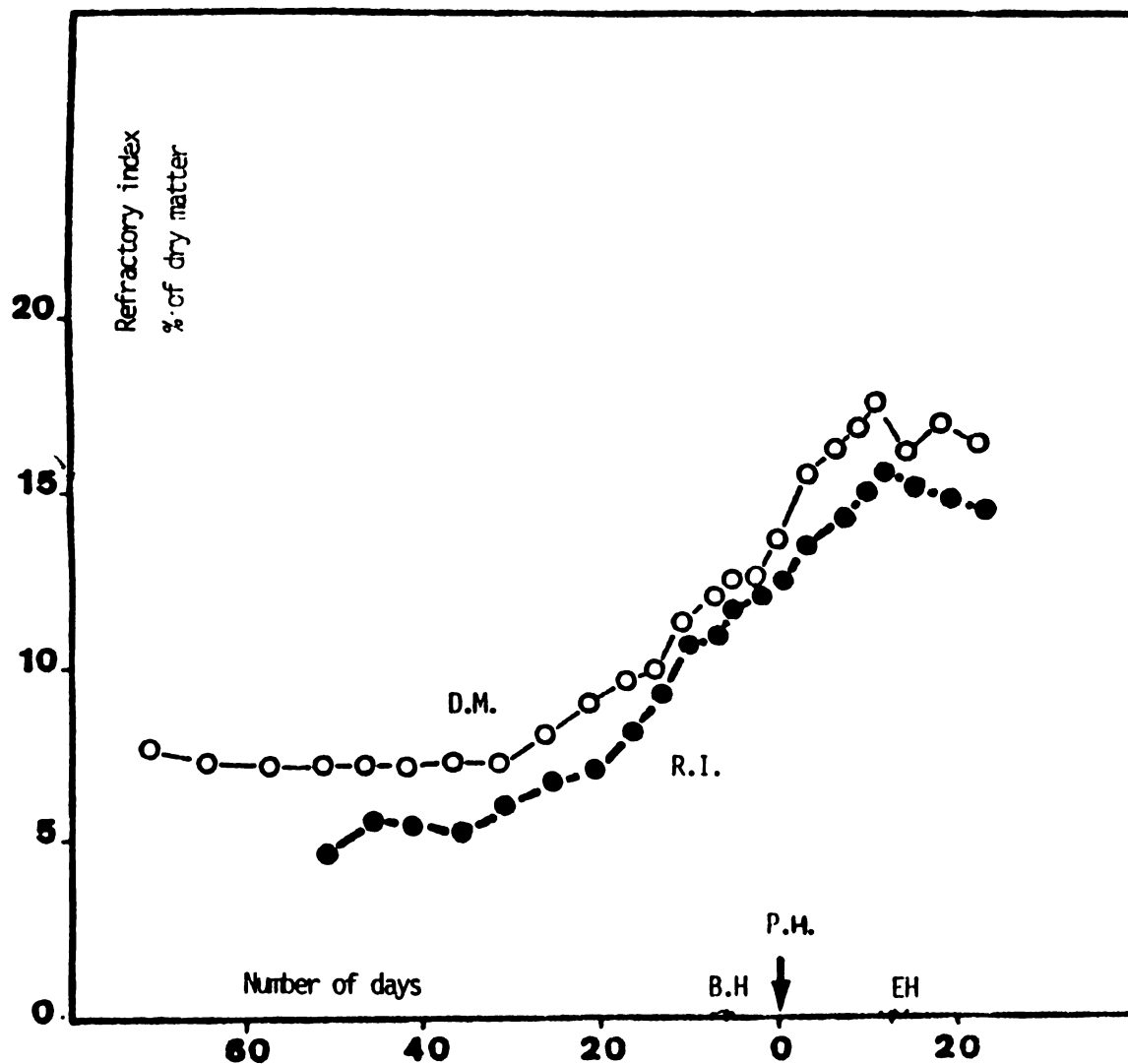
These two points are extremely important to get a high quality of fruit which is determined by the external aspect and the internal characteristics (flavour, sugar content and acidity).

In Europe, the most appreciated fruits have a brix over 15 and an acidity of 10 to 12 mg/100 ml of juice.

Sugar content and acidity depend on the stage of ripeness of the fruit at harvest time. The increase of sugar content and juice acidity is very fast during the ultimate stages of ripening (Figures 1 and 2). The acidity increases during a refrigerated storage or transport but decreases without refrigeration. For these reasons it is extremely important to adjust the time of harvest to the optimum of these two criteria.

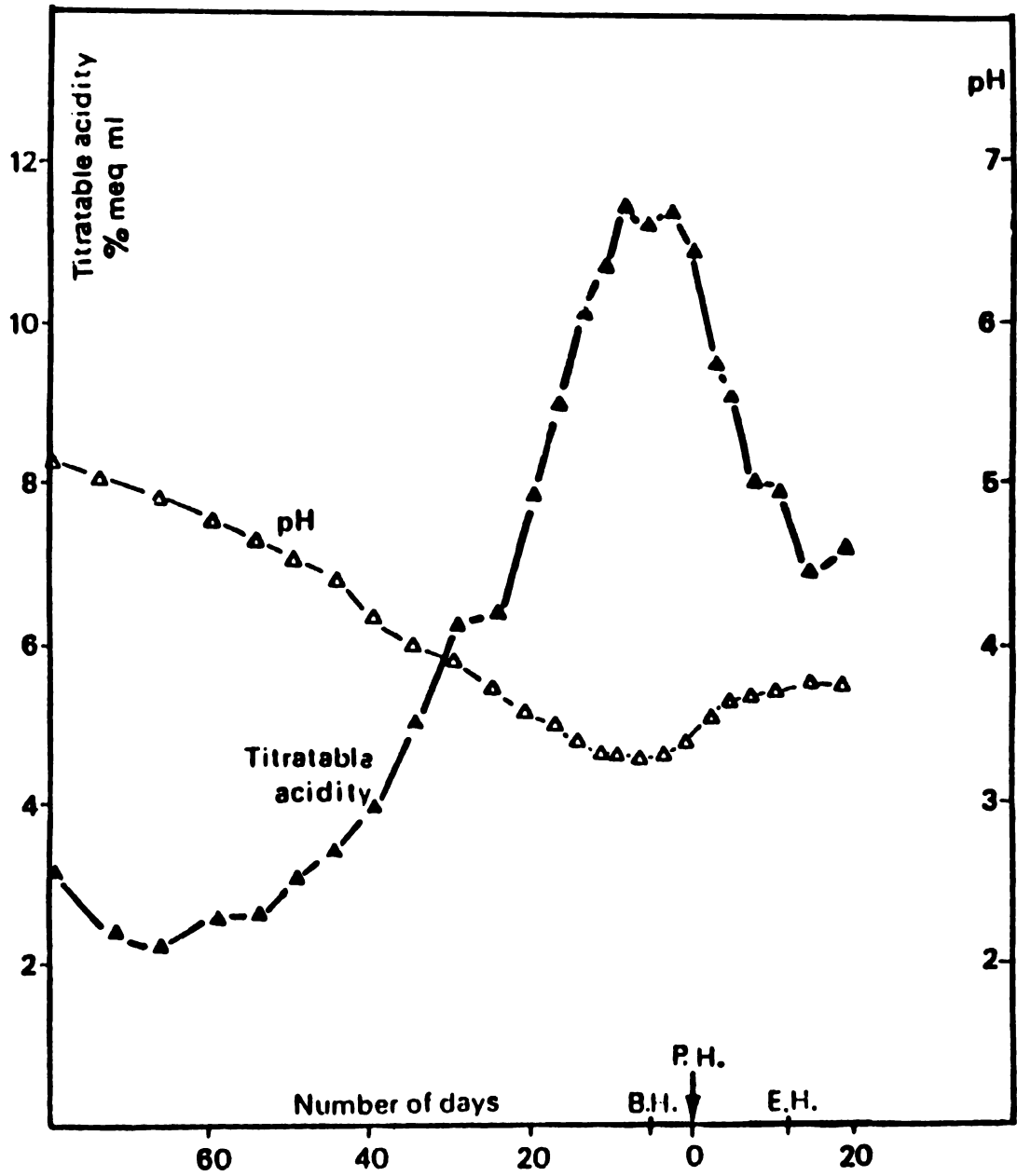
Sugar content and acidity are variable with the climate: temperature, water consumption, solar radiation (Figure 3). They

Figure 1: Changes in the refractory index in the juice and the dry matter content of the flesh as harvest approaches



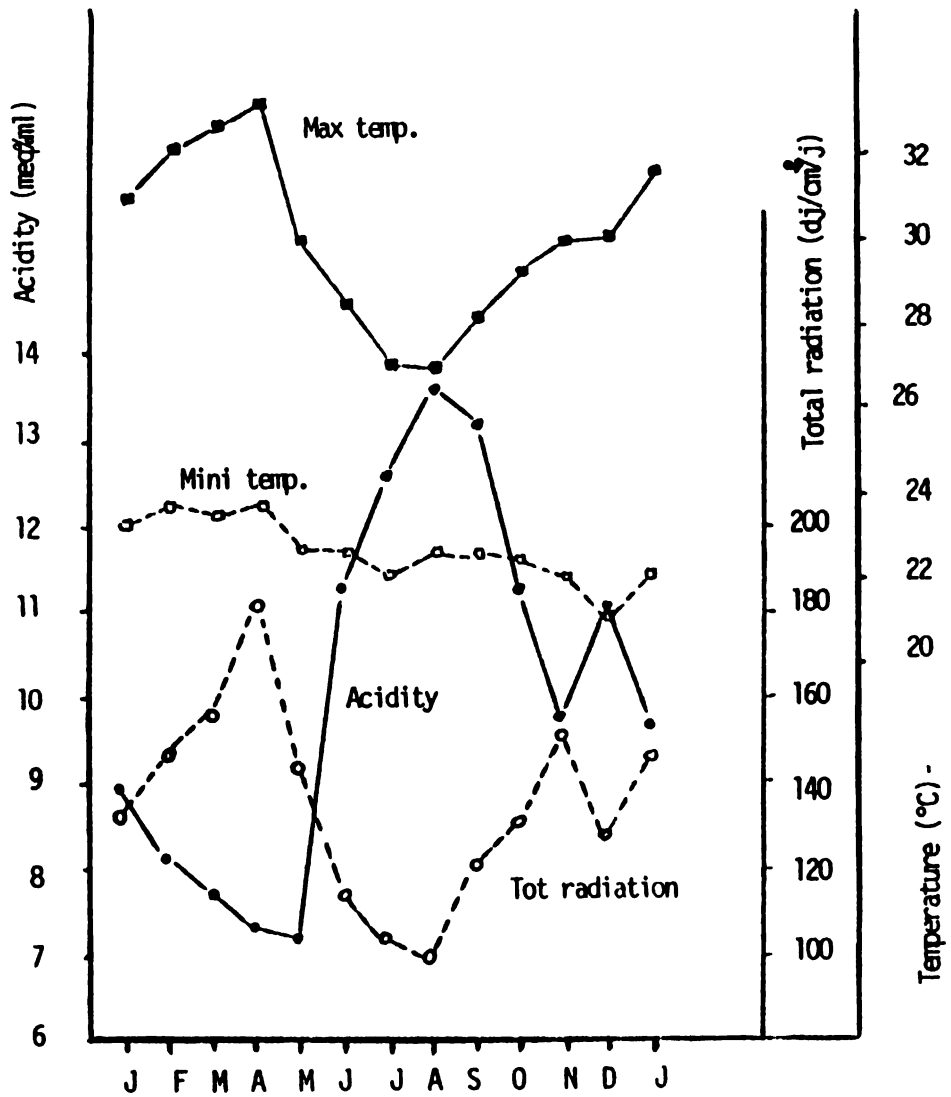
BH = Beginning of harvest of plot
 PH = Peak of harvest
 EH = End of harvest

Figure 2: Changes in titratable acidity and in pH of juice as harvest approaches



BH = Beginning of harvest of plot
 PH = Peak of harvest
 EH = End of harvest

Figure 3: Variations in titratable acidity in the juice as a function of the harvest month in Ivory Coast



can be controlled by fertilization and particularly by potash fertilization. The fruit peduncle should be cut 2 cm. long from the plant with a sharp knife and not broken off. All the leaves attached to the base must be pulled off. The fruit must be very carefully put in plastic or wooden boxes to prevent shocks during transport from the field to the packing house. The farm roads must be well kept.

PACKING THE FRUIT

At the packing house various processes follow in a logical sequence (Figure 4).

1. Sorting

Removal of any fruits with serious defects in appearance:

- green ripe fruits by dipping in water
- unripe or overripe fruits
- too small or too big fruits (less than 700g. or more than 2,300g)
- bruised fruits particularly sunburned ones
- fruits with multiple crowns, damaged crown
- fruits with broken peduncle

2. Preparation of the fruit

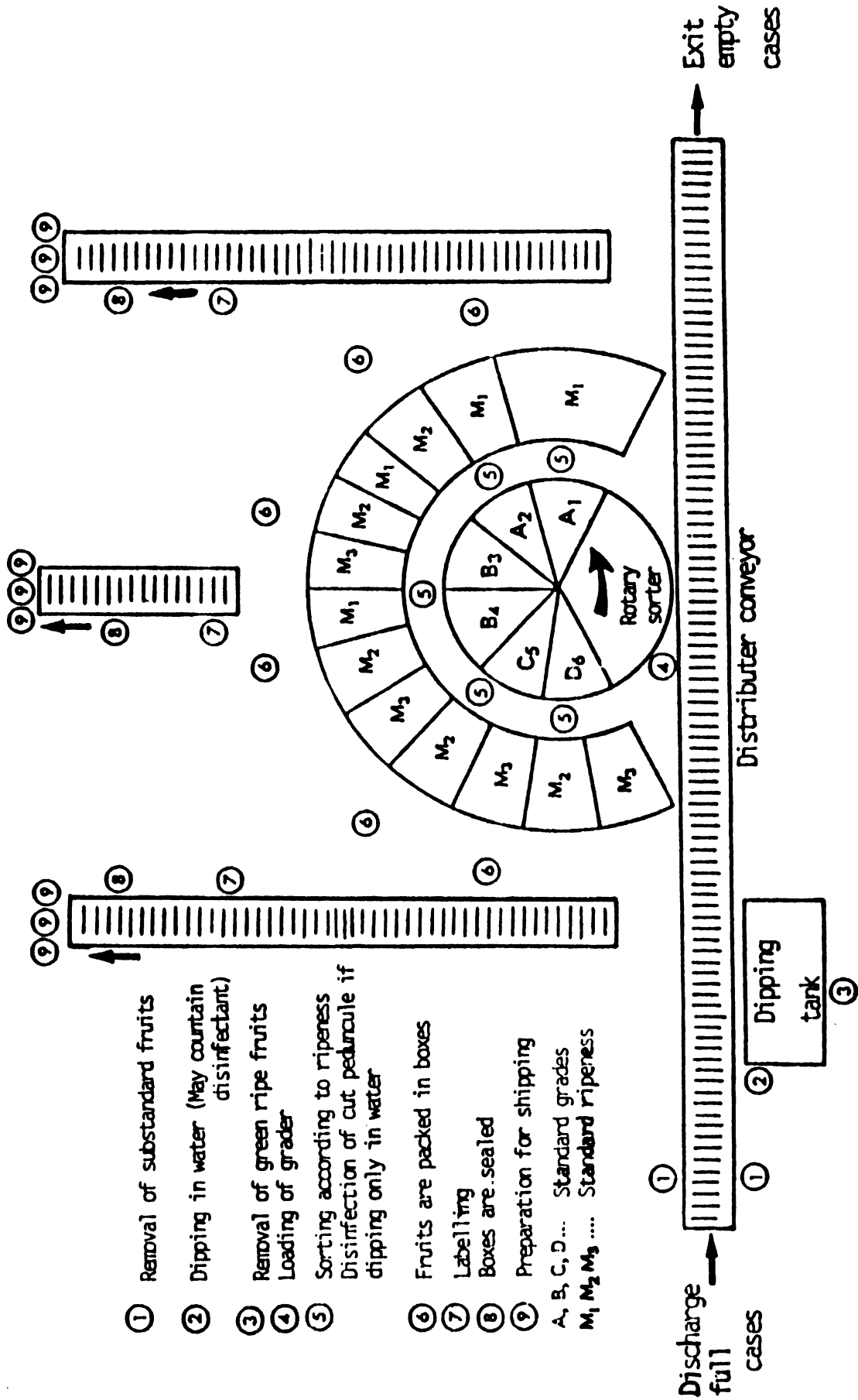
- removing the bracts at its base
- trimming the peduncle to the required length
- brushing with a very soft brush to eliminate mealy bugs.

The most important of all is protecting the fruit against infection by *Coratocystis paradoxa*. Just the cut end of the peduncle can be treated. Recommended products depend on the regulations of the countries where the fruits are imported. The main used products are: Benomyl (0,15 to 0,30% a.i in water), Triadimefon (0,05 to 0,10% a.i in water), Imazalil (0,01 to 0,02% a.i in water), Thiabendazole (0,15 to 0,30% a.i in water). Additional treatment can be carried to prolong the life of the fruit by limiting respiration. Certain waxes reduce weight loss and the increase of acidity according to refrigerate storage or transport and can improve the appearance of the fruit and its brightness.

3. Grading

Grading the fruits is carried out by weight (for export to Europe) or by maximum diameter (for export the USA) because the importers prefer boxes with fruits of the same size. Grading by weight is done manually by using a simple scale balance or a rotary weighting machine.

Figure 4: Diagram showing the organization of a typical centre of packing in Ivory Coast



4. Sorting the Fruits according to ripeness

Fruits are usually classified in 3 different classes of ripeness for each size of the fruit.

5. Packing

Usually fruits are packed horizontally in 1 to 3 layers or vertically in cartons or other types of boxes (soft wood, polystyrene). In the first case few standard sizes of boxes are required and the fruits are packed head to tail. In the second case individual protection and ventilation are better but several different sizes of boxes are required and palletization is difficult.

Boxes should be attractive and easily distinguishable with respect to grade (size or category of weight), ripeness, cultivar, origin of the fruits (farmer's name).

DISINFECTION OF THE PACKING STATION

After all the process of packing the fruits, if the packing takes several days, the floor, work surfaces as well as the boxes used for harvesting should be cleaned treated with a 2 or 4% formaldehyde solution to prevent the spread of diseases.

STORAGE AND TRANSPORT

If the fruits have only to be transported on a short distance (local market) or if they are sold without delay (transport by air) adequate ventilation is the only requirement to ensure the fruits arrive in perfect condition at the retail, that is, once bruising is prevented during harvest and packing and fungicide treatment has been correctly carried out.

If the fruits are to be transported over long distances for a journey of several days or weeks, refrigerated transport is required to slow down the ripening process. 8°C is the optimum temperature.

Fruits cannot be stored at this temperature for more than 3 or 4 weeks to prevent noticeable deterioration of fruit flavour. Refrigerated conditions must be unbroken until the fruits get to the consumer or at least to the supermarket or the retailer. In the case of a break in the refrigeration, enzymatic activity can induce an endogenous disorder called internal browning. This type of disorder can occur if refrigeration is interrupted at any time. Browning of the flesh shows signs of damage when the temperature rises up that means when the fruit is on the table of the consumer. A break of the refrigeration can also induce a deterioration in the

appearance of the fruit: yellowing of the crown of which the leaflets dry and infestation of the skin by pathogens due to condensation of water.

Transport or storage at a temperature of less than 7°C induces degradation in the appearance of the fruit: Skin colour turns to dark brown, and at the same time in the flesh: an important decrease of acidity in a few days and a liquification of the tissues.

SANITARY PROBLEMS

It is possible to distinguish some main important problems in or on the fruit after it is harvested and during transport.

Deterioration due to Parasite

- Black rot due to *Ceratocystis paradoxa*

The fungus *Ceratocystis paradoxa* is the most important wound pathogen entering through any open wound on the skin or the cut peduncle. Rapidly the flesh turns soft and watery with a black colour and a sweet smell. At a temperature of 8°C the development of the fungus is slowed down. To prevent its development it is necessary to handle the fruit with care to prevent wounds, to disinfect the cut peduncle or the entire fruit and to ensure refrigerated transport or storage at 8°C.

- Black rot and Leathery pocket

These two alternations are due to *Penicillium funiculosum* and *Fusarium moniliforme*.

Usually Smooth Cayenne fruits do not show any external sign and for that reason sorting the fruits is difficult. The control must be carried out by sampling the biggest fruits (examination of the flesh) during the most favourable periods for the disease.

For other cultivars (Queen - Mordilona) external symptoms are perceptible and sorting the fruits is easier. The surface of the affected fruitlet is deprimed and takes a green brown colour.

The infection of the fruitlets takes place after the forcing time when the inflorescence is rising in the heart of the plant and then during the flowering period.

The rot goes during the maturation of the fruit.

The control of this disease is not yet effective.

Other Diseases

Thecla basilides: This butterfly gives a grub which enters the fruit during its development and digs cavities. By reaction of the tissues it is possible to see an exudation of gum.

This pest is only localized in South America and Trinidad and Tobago.

Fusarium moniliforme var. subglutinans: This fungus can affect all the plant and the fruit. At the moment it is localized only in Brazil where its presence is a restriction for the development of the pineapple culture and a serious problem for the growers. For this reason it is very dangerous to introduce plants or fruits from this country.

Deterioration due to Physiological Disorders

Green ripe fruit: In this case the flesh is ripe or overripe but the shell is quite green. These fruits are extremely juicy and delicate and do not support transport. The elimination of these fruits is carried out by dipping them in a tank of water. This disorder takes place usually in hot and wet season with a high level of sunshine a short time after a dry season when the rain begins.

Internal browning: This disorder is different to the black spot and it is due to refrigerate storage or transport. The development of internal browning is divided into two phases: the first phase occurs during storage on transport at chilling temperature (12°C) without symptoms and the second phase is the period after the fruit has been removed from refrigeration. During the second phase the symptoms of internal browning develop.

Smooth Cayenne fruits are more susceptible to this disorder because they have a very low level of ascorbic acid content and all the treatments (fertilization, shade) which increase the fruit acidity decrease the incidence of this disorder.

CONCLUSION

It can be said that quality of the fruit is imperative for export. We emphasized the fact that growers have an important role to play. However, exporting has to be taken as a whole not only at the farm but for transportation and commercial aspects. It means that an organization has to be set up at the scale of a competitive marketing scale.

PACKAGING AND LABELLING REQUIREMENTS FOR EXPORTING

by

Edmund Brandt, Packaging Advisor
Eastern Caribbean States Export Development Agency

PACKAGING AND LABELLING REQUIREMENTS FOR EXPORT

This section of the workshop will define the current and future requirements for exports of horticultural commodities and others into the North American and European Community Markets.

We will discuss the urgency of getting exportable goods in a condition legal, and conform to the present and future food laws, through customs, sanitary inspections and consumer acceptance.

This myriad of information will be discussed in different sections:

- Labelling
- The Label itself
- Bar codes
- Retail Packaging
 - a. Plastic Packaging
 - b. Corrugated Packaging

Thereafter we will discuss other aspects of packaging if time permits:

- Tamper-evident Packaging
- Hygiene of Packaged Foods
- Adulteration of Foods
- Commodity Packaging Requirements
- Additives with European "E" numbers
- Spice Trading "Minimum-Maximum" requirements
- List of Regional Packaging Companies

At this presentation we will show, the date 1992 is the time when the European borders will fall, but it does not mean that we should wait until then to correct our handling of food exports. Now is the time, if we waste it now we cannot protect our national interests.

European importers are faced with heavy competition. They can remain in business only if they are able to meet basic requirements of the market, namely; reasonable prices, impeccable quality (particularly with respect to Food Regulations) and smooth, efficient service. If the European importer is to fulfil these conditions, his foreign supplier must be a reliable long-term

partner rather than a one-time or occasional seller of goods. Both have to cooperate in a flexible manner, so as to be able to adapt to the changes in Food Regulations resulting from scientific progress and new legislation, as well as to frequent changes in consumption habits.

Consumer preferences regarding packaging may also change: for example, jars have replaced cans in certain cases, and new sizes of packages have been introduced. Therefore, the importance of packaging as a factor in the successful marketing of a product should not be underestimated.

Poor or inadequate packaging is one of the factors which contribute mainly to post harvest losses, consumer rejection and spoiled or rejected processed foods. Packaging materials with insufficient strength will collapse, split or bulge, resulting in the physical loss of the product.

We distinguish several types of packing:

- Fibreboard cartons - corrugated, etc.
- Wooden crates
- Sacks and nets - (internal packing)
- Baskets
- Plastic packaging
- Retail packaging

I will try to explain these individual Packaging and Labelling methods now in more detail.

First we need to set-up a check list of Technical Requirements. We have to research the information available on each particular product.

- Are there any certification schemes in operation?
- Are there any quota regulations in effect?
- Are there any ecological prerequisites?
- Are there any particular circumstances under which the product has to be used?

Many other requirements have to be checked before starting to produce or to export any food, foliage, etc. into the European Community and North America.

TECHNICAL REQUIREMENTS

The following is offered as a basic check list of technical requirements for a manufacturer seeking entry into a new market.

1. Are there any laws and regulations (national or sub-national) directed specifically at the type of product concerned?

2. Are there any general laws and regulations which are directed at use of the product under particular circumstances (eg. consumer protection, worker protection, environmental protection, energy conservation, etc.)?
3. Do the requirements relate to the product 'as new' or do they also relate to aspects such as installation, maintenance, serviceability, etc.?
4. Are there any national standards which relate to the product or its components for materials? What is the status of these standards (mandatory, voluntary, etc)?
5. Are these national standards based on any harmonized or international requirements?
6. Are there technical requirements or specifications affecting the product, issued by organizations other than the national standards authorities, (eg. Insurance organizations, trade associations, public sector companies, etc.)?
7. Are the relevant texts of these requirements available and in which language?
8. Are there any certification schemes in operation for the product and if so, what is their status (mandatory, voluntary, etc.) and recognition? Will a foreign certification scheme be acceptable and can use be made of existing test reports etc.?
9. If a certification scheme exists what are the details, ie. technical requirements, sampling procedures, qualifications of personnel factory visits, estimated costs, time involved, requirement for local agent?
10. Are there any requirements in the country with regard to quantities and units, product liability, patent and trade marks, warranty procedures, language?

ELEMENTS TO CONSIDER FOR LABELLING

- Deceptive Packaging
 - Exaggeration of colour
 - Of content
 - Too large
 - Places of origin
- Size of Lettering

- Net Content/Drained Weight
 - Accuracy in weight or volume
 - Standardization of pack 'e' numbers
- Additives
 - Preservatives only with 'E' numbers
 - Colorants 'E' numbers
 - Other substances (boric acid, Salicylic acid, formaldehydes splitting compounds, etc) are not permitted.
- Manufacturing or Expiry Date
- Made where?, by which Company? and/or imported by whom?
- Bar Codes
- Size of 'Product Description' - 2/3 of rest
- Ingredient Statement
- Usage and Storage Instruction

Labelling

Under deceptive packaging we understand the misleading information and false picture indication of what the content of the package will or will not contain. Thus the consumer is not buying his monies worth. Consequences arising out of this malpractice can or will cause severe consequences for the producer in cases of retail packs directly brought into commerce or to the importer or end manufacturer in cases of semi-elaborated products.

The size of the letters on the label will be discussed with the next slide.

Accuracy in weight or volume of a retail pack is limited to a small percentage of discrepancies. This holds true for underweight as well as for overweight. If the volume is larger at the time of filling the container, the label should indicate this.

Overweight/volumes carry the same consequences as underweight. For example, a company produces a rum in a 750 ml. bottle. The label indicates 80% proof, but in reality the product holds 85% proof, thus cheating the tax authorities on their revenue and hence will cause heavy fines.

In the case of canned products, like fruits in syrup, the drained weight of the fruit without the syrup has to be indicated.

Additives are at the moment legalized by the individual

importing countries. Hopefully this problem will be solved in Europe after 1992.

However, some items have already been cleared and are adopted for all of Europe. Such are the capital "E" numbers followed by a number for allowed additives. Also the small "e" Euronorm - preceded by a weight or a volume indication.

As to further information that have to be included on a label for the EEC and North America are the manufacturing date or the expiry date. This information has to be marked in an easily understandable matter. Codes are prohibited. In lieu of the expiry date a company can use a "best before" consumption date.

The manufacturing company or the last company who handles the product has to be predominantly indicated by an address easily understandably. In some cases where the importer will take over all responsibility and guarantee, the importers address can be written on the label.

In the modern equipped supermarkets, scanners are installed, reading the imprinted "Bar Codes" on the labels. Thus eliminating errors in pricing and giving the purchasing department of the supermarket an indication of storage movements, public acceptance of a particular product and controls on thefts. Further information will be given in the respective slide presentation.

The ingredient statement should always be written in the order of predominance of the ingredients used. Large enough to be easily read. Percentages of each individual ingredient are not required. However, one should observe the legality of each ingredient before manufacturing.

If the product needs any special attention it should also be stated on the label. Such as: keep frozen, keep cool, keep dry, do not store near heat above ... etc.

This section on labelling can be so confusing that it would take a two-week workshop only to straighten out the basic problems. Therefore my suggestion is to contact specialized lawyers in international food laws, to be absolutely sure, or send a small amount - sample - to the importing country and have them give you, your products blessings.

Let's not try to be overconfident on our products and think, that your product has sold within the national boundaries, it has to sell also in the export markets.

Let's not try to cheat, and think they will never find it. IT's wrong and it will be found. If not by their health departments of the importing country or their custom checks, no, it happens mostly through other competitors. They will analyze

and check your product more than the authorities in order to get that market away from you and get your a heavy fine. So be extremely careful when making statements, using ingredients or trying to deceive.

LABEL INFORMATION

- Nutritional Information
- Antioxidants (BHA/BHT/TENOX/etc.)
- Approval Numbers
- Letter Sizes (5-50, 2mm, 50-200, 3mm, 200-1000, 4mm, over 1000, 6mm)
- Storage Specs.
- False Labelling/Illustration/Statement of Origin
- Sulfur Dioxide (under 50mg/kg not to be labelled)
- Concentrates (The concentration has to be indicated)

THE LABEL ITSELF

Should a company decide to indicate any nutritional information on their product label, then one has to ultra specific in what he will write or indicate. It will not suffice to say, "good for your health" or say, "this is an aphrodisiac". This information has to be extremely correct and can be backed up by experts or expert laboratory tests. The stated nutritional values, should not be influenced during processing, before or later, storage or later decomposition.

The health departments of the importing countries are extremely sensitive to any of these types of statements. The best is not to write them or make them and let the local authorities decide together with the domestic manufacturer or importer, what statements they will allow.

Approval numbers are not required for exports to Europe, but will facilitate any processing within the authorities inside the importing country. In some cases it will be advantageous to indicate if a company holds a "Department of Agriculture Pennsylvania Number". This hold especially on meat or meat exports to the States. Or on highly perishables for retail packs and customs clearances.

Illustrations on labels should not exaggerate the actual

product or contents. It will not be allowed to show a picture of hundreds of strawberries, when the product was flavoured with a synthetic strawberry flavouring agent. Nor will it be permitted to show fresh oranges dripping with juice, when the product was made from concentrate.

When a statement of origin is made, the manufacturer can only use the wording that the product is from the region where the raw materials came from. We cannot call a cheese made in Trinidad, a Swiss Cheese, when no raw material from Switzerland was used. But what we can do, is to say: Type of Swiss Cheese or manufactured like Swiss Cheese.

Whatever statement we are trying to use, it will depend on how the wording is formulated. Describing a product or a process is not prohibited, but encouraged.

BAR CODES

- Significance
 - readable scanners
 - inventory control
 - original produce
 - purchase price
 - commodity
 - sales price
- Ways to obtain a Bar Coding
 - UCC (Uniform Code Council Inc.)
 - Membership
 - Types of masters
 - a. UPC Film Master
 - b. EAN Film Master
 - c. SCS Shipping Carton Master
 - d. Code 59 Master
 - e. Emulsion down or up
 - f. Metric or English Measure
- Assignment of Company Code
- Assignment of Characters
- Costs
 - Classifications
 - Manipulation
 - Department Store
 - Bookstore
 - Size of Company
 - Broker/Importer
 - Total Turnover

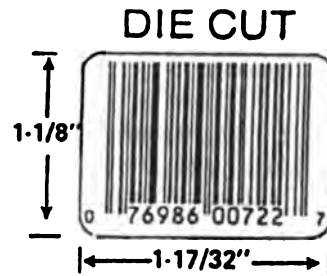
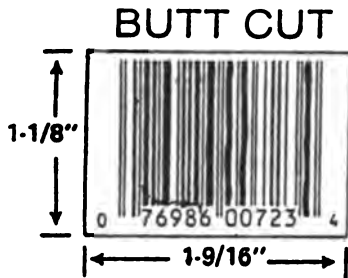
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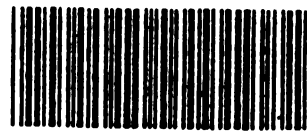


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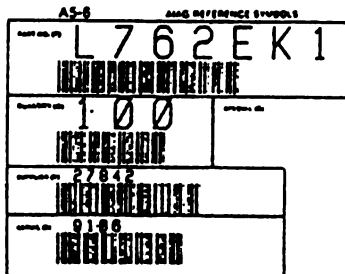
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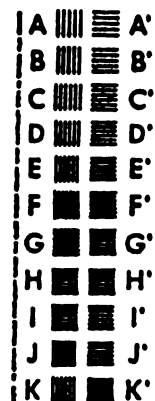
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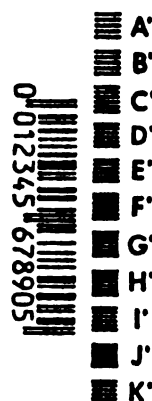
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Quick Check 4 is the most advanced bar code verifier on the market. It is compatible with Code 39, Interleaved 2 of 5, UPC/EAN, Code 128 and Codabar. You can do PCS on the "fly". And many more advanced features make Quick Check 4 the leader in the industry.

Quick Check 3

Quick Check 3 verifiers are menu driven and feature a two-line, 32 character LCD. It can match your symbols to the five codes that are the standards used by seven different industry groups, or be custom programmed to meet your in-house format applications.

Quick Check II

Quick Check II is an economical, easy-to-use bar code verifier for confirmation of bar code quality. It can be used to confirm the following codes: UPC including addendums and Version D, EAN/JAN including addendums, SCS, LOGMARS Code 39, Code 39 with and without check digit and Interleaved 2 of 5 with and without check digit.

Bar Codes Contacts in some countries

For USA, Canada, Germany, UK

Contact: UCC - Uniform Code Council
81636 Old Yankee Road
Dayton OHIO 45458
Tel: (513) 435-3870

To receive from the Food Marketing Institute your UPC Manufacturers Code Number and the number of characters to be used in order to get the Film Masters.

For Spain contact: Codebar

Via Augusta 59 D-407
E-08006 Barcelona, Spain
Tel: (93) 217-77-52

RETAIL PACKAGING

- Size
- Make up (Window pack/Language)
- Colour (Impact/Value/Combination)
- Type of (Portion pack/Family pack/etc.)
- Image, Colours (Aesthetics/Shape)
- Pilfer-Proofing
- Brand Names (Registered/Area Names)
- Functional Design
- Usage/Instructions
- False Presentations

When designing a retail pack, a study should be undertaken to find out, what is the ideal size of that particular retail pack for that particular country. Some countries have large families. Others have small families with only one child or less. Again others have a major percentage of older persons. Is your product a luxury item or will it be sold in a discount supermarket. All these thoughts have to be investigated and cleared before going to the packaging designer and/or the packaging company. It will save time and monies when all home work is done before and properly

executed.

The next step is to find out what do we want to promote:

- Something of value, then colour is an important factor as well as the total presentation. Or do we want a functional design. In any case colours are important in marketing, brain washing and presentation. Let's take the primary impact colours: red, blue or yellow. Almost all successful products contain one or more of these two colours in their package design. Then we distinguish a set of value colours: gold, silver, bronze, etc. They indicate that the product contains a small amount, but is of high value. Like in perfumes. Last we can find a large variety of secondary colours, they are mostly used in rounding up an impression.
- To show our product, sometimes through a window pack. Or do we want a particular language in order to impress the buyer. This holds true in cases of perfume sales, where one tends to use the french or english language, or combine the two.
- The type of retail pack. Is it a portion pack, a family pack, a convenience pack or other. The aesthetics and the shape of this type of presentation is half the sale.

Recently, thefts in supermarkets have increased tremendously. Due to various reasons. Therefore the industry is required to design their packaging in a manner that products will show if someone has tampered with it. We will discuss this later in more detail.

When we decide to use any brand name for our product, then it will become necessary to conduct an investigation on the name we will want to use. This is usually done by a patent lawyer. In Europe its the Patent Office, located in Munich-Germany.

Usually the brand names are derived from names of companies, from persons living or dead, areas, regions, animals or word combinations in shortened or enlarged forms. But one should always be aware not to mislead with a brand name, what the product does not hold.

PLASTIC PACKAGING

Basic characteristics of plastic materials:

Food Grade Plastic

- Direct contact with product
- Indirect control

Non-food Grade Plastic

Extruded, Laminated, Co-extruded

- Porous material
- Light and fat resistant material

- Heatable containers
 - In steam or hot water
 - Microwave
 - Hot fill

- Sealing capacity
- Biodegradable
- Blow moulding
- Pre-formed
- Netting

Here we can differentiate between Food Grade Plastics and Non-Food Grade.

In the first case we have to know if the product comes in direct contact with the product or is it an indirect contact.

The direct contact happens for example with sausage casings, or a wrapper around candies, butter, chocolate, etc. Therefore, only limited types of plastics are allowed to be used. A list of these allowed plastics can be obtained from any of the plastics companies which are listed at the end of this paper. In the meantime I will try to explain some of them and their functions.

Mylar with combinations, polypropylene, polyethylene, saran, cellophane, coated paper or carton, waxed paper or carton, etc.

With indirect contacts the range of available plastics is much greater and will not have any direct influence on the finished product itself. It is only there to give an additional protection or to combine several individually wrapped item into one. Sometimes it is the shipping container which will take this task, but the majority of the intermediate packaging will be put again into a shipping container of a larger volume.

When choosing the right material it is important to know, how the product, (plastic) is manufactured. Is it extruded, laminated, co-extruded, etc. Is it a porous material, light or fat resistant. Is it heatable in steam or hot water. Can it withstand a hot-fill or microwaves?

All these questions are important in order to solve our problems before they occur and we start packing our product for the national or international market.

We might consider in addition to observing all the aforementioned items, that some countries have adopted strict measures to combat pollution and therefore favour any packaging which is either biodegradable or re-usable.

Basic Technical Specifications for the Procurement of Corrugated Boxes

- Designation of box
- Product to be packed
- Quantity and arrangement of contents in the box (alternatives)
- Style/construction of the box, including interior fitments
- Type of corrugated board/flute configuration
- Quality grade of corrugated board/eventual raw materials specifications
- Minimum required bursting strength (Mullen)
- Inside dimensions of the box/eventual tolerances
- Type of manufacturers' joint
- Special features/treatments
- Detailed printing instructions, including quality certificate stamp
- Quantity of purchase (alternatives)
- Method of packing/shipping empty boxes

Make sure that the best possible raw materials are used (liners, corrugating medium, adhesives, etc.). Pay particular attention to various possibilities of increasing the moisture resistance of the boxes. Avoid bleached or mottled liners which might unnecessarily weaken the strength of the boxes by 5-10 per cent. If you are using A-flute, consider changing to C-flute. Your supplier should give you a price bonus for less raw material used.

Pay particular attention to technical details which might influence the strength of your boxes:

- Avoid excess printing even with the best manufacturing practices, printing pressure crushes the corrugations of the fluting. In particular this concerns continuous, horizontal band-like patterns. In most cases, one colour printing is enough. You should also seriously consider unprinted boxes with glued-on printed labels,
- If ventilation slits or holes etc. are to be incorporated in the box design, see to it that they do not unduly lower the strength of the side of the box and in a horizontally staggered pattern,
- The top and bottom closures should be, at least, as the other parts of the box. Use a full coverage of moisture resistant adhesive to bond the flaps strongly together. Gummed paper

tape should be of very good quality, preferably of a reinforced grade. Use mechanical tape moistening equipment and clear such equipment thoroughly after each working day. It is an unnecessary waste of money to extend the tape more than 24 inches (60mm) over the edge of the box.

Stapling/stitching should be executed with great care - watch out for incorrect clinching of staples and stitches, particularly in connection with wide crown top stapling,

- Study eventual applications of plastic strapping to reinforce your boxes,
- It might be possible for your box supplier to extend the manufacturers' joint lap partly into the top and bottom flaps of the box. This will reinforce the corners at no extra material.

In the distribution to the local market, look for opportunities to make the boxes returnable, to be reused 2-3 times.

Store empty boxes as dry as possible. 50 per cent RH is ideal: Stack bundles flat, do not store directly on the floor, do not walk on box bundles, rotate stock on a 'first in - first out' basis.

When delivering your products, packed in corrugated boxes, make sure that they are not lifted on board ship in nets. Even if loads unitized, pallets should be used in ship loading, with spreaders between slings, to prevent cutting into the boxes.

NAME OF BOX MAKER GUARANTEEING BOX

**BOX CERTIFICATE
THIS SINGLEWALL**

BOX MEETS ALL CONSTRUCTION

REQUIREMENTS OF APPLICABLE

FREIGHT CLASSIFICATION

BURSTING TEST	200	LBS PER SQ/INCH
--------------------------	------------	----------------------------

MIN COMB WT FACINGS	84	LBS PER MSQ FT
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SIZE LIMIT 75 INCHES

GROSS WT 66 LBS

CITY / STATE (HERE)



SINGLE FACED BOARD



DOUBLE FACED BOARD



DOUBLE WALL BOARD

CLOSING: STITCHING / GLUEING / TAPING

**PARADISE
PRODUCTS**

Tropical Fruit Juice

made from concentrates

**Ingredients: water, pineapple concentrate,
orange concentrate, tamarind, sugar, glucose
citric acid E..., colorant E..., preservative,
Benzoate E...**

Manufacturing Date --/--/--

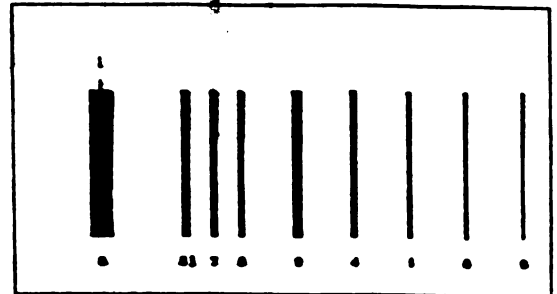
Expiry Date --/--/--

**Manufactured by:
ABC Co. LTD. Grenada, W.I.**

**Net volume
250 ml**

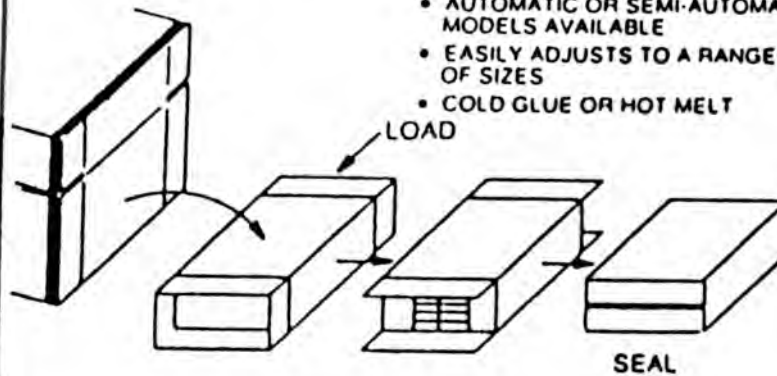
**Distributed By:
XYZ Co., Hamburg FRG.**

Bureau of Standard No - - - - -



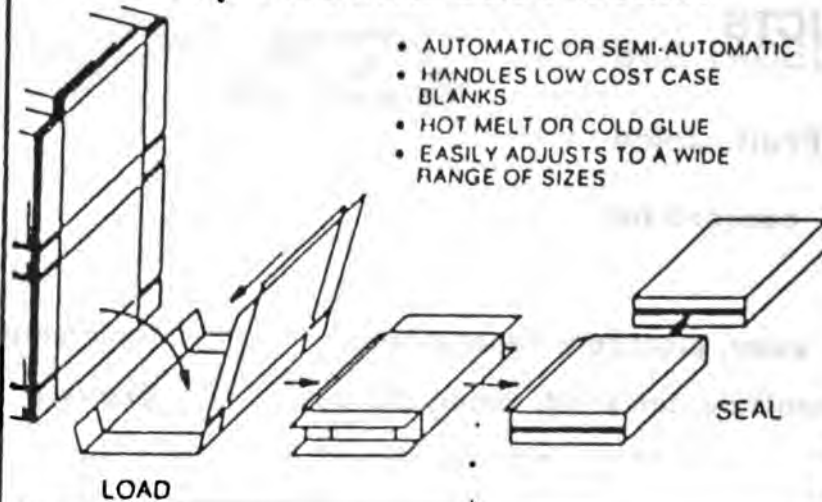
Case Packer

- BOTTOM SIDE OR END LOAD STYLE CASES
- AUTOMATIC OR SEMI-AUTOMATIC MODELS AVAILABLE
- EASILY ADJUSTS TO A RANGE OF SIZES
- COLD GLUE OR HOT MELT



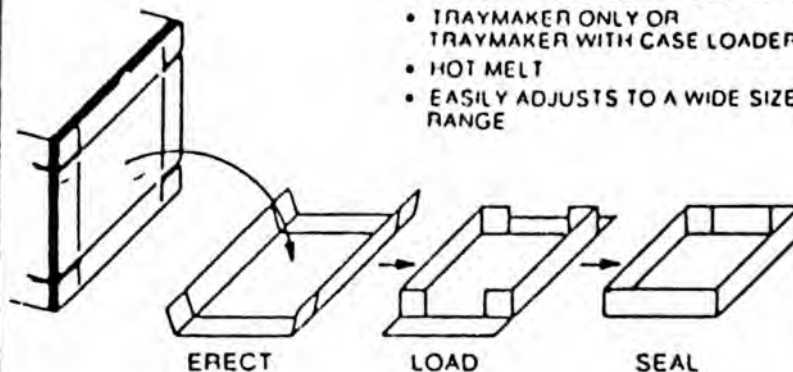
Wrap-Around Case Sealer

- AUTOMATIC OR SEMI-AUTOMATIC
- HANDLES LOW COST CASE BLANKS
- HOT MELT OR COLD GLUE
- EASILY ADJUSTS TO A WIDE RANGE OF SIZES



Traymaker/Loader

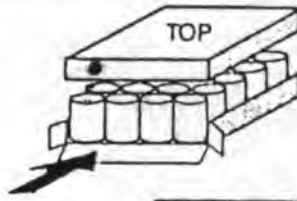
- AUTOMATIC OR SEMI-AUTOMATIC
- TRAYMAKER ONLY OR TRAYMAKER WITH CASE LOADER
- HOT MELT
- EASILY ADJUSTS TO A WIDE SIZE RANGE



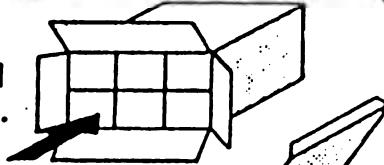
Tray & Case Packers To Pack Products Like These . . .



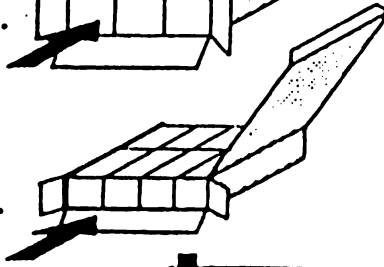
Into
Trays . . .



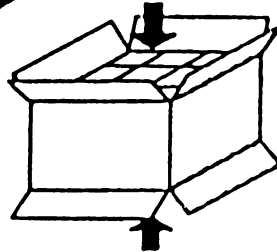
Horizontal
Cases . . .



Wrap
Around
Cases . . .



. . . And
Vertical
Cases.

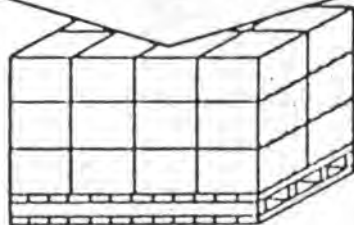


Can Seal Cases/Trays With:
Hot Glue • Cold Glue • Tape

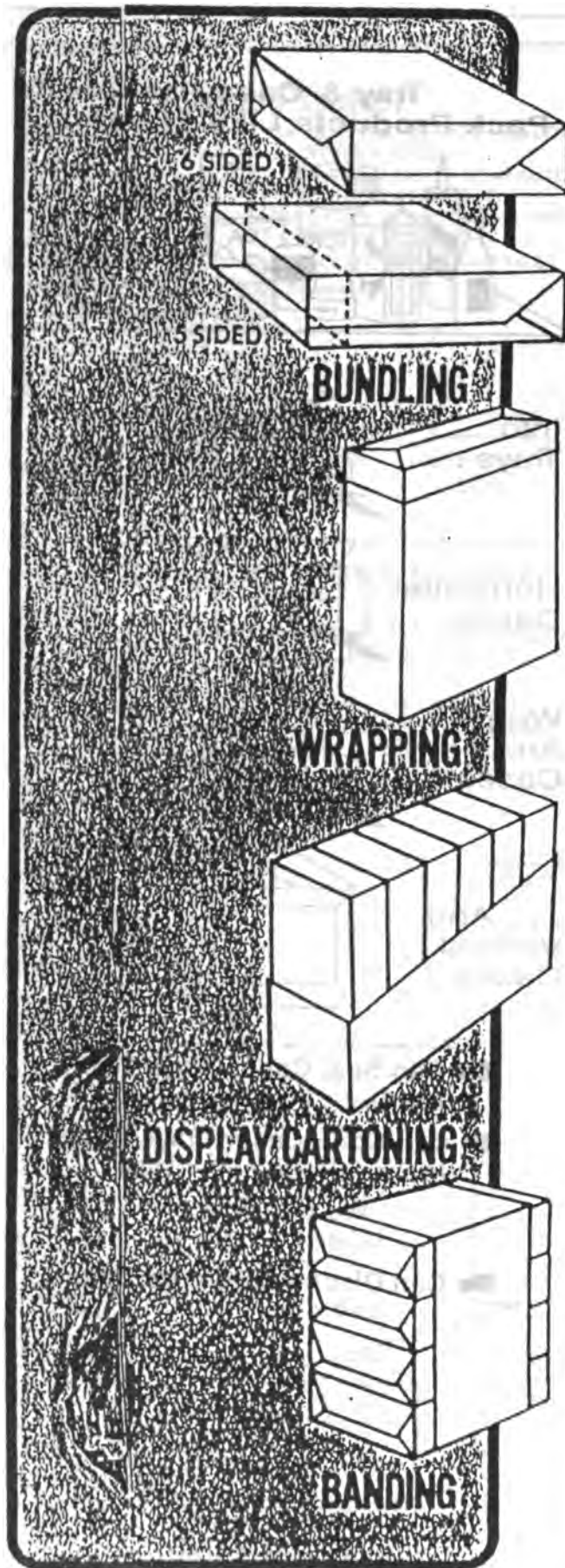
Can Code Cases/Trays With:
Imprint • Roller • Ink • Label

We Can Add:
Dividers • Leaflets

Can Discharge Cases/Trays:
Left • Right • Up



And Palletize.



TAMPER-EVIDENT PACKAGING

Tamper-evident packaging of food products has progressed quickly - so quickly that some suppliers of tamper-evident materials and supplies are already predicting saturation within three years. By that time, they say, virtually all packaged food will incorporate some sort of tamper-evident device.

Shrink banking and shrink-sleeve labelling have led the way in new tamper-evident applications for food, apparently because of the cost-effectiveness, versatility and decorating options available with these types of devices. Even the dairy industry, with its razor-thin profit margins, has made a nearly total conversion to shrink banding.

Marketers of several types of personal-care products have also taken advantage of the tamper-evident and decorative possibilities of shrink bands. These include mouth-washes, toothpastes, dental rinses and analgesic liquids for both children and adults.

It's the ubiquitous neck bank - a ring of PVC or other plastic which is automatically applied to the mouth of the container and shrunk tight around the container with applied heat.

Paper neck cylinders which are not shrunk to fit, but instead glued on like a prime label, are also used.

Within the past two years, however, not only have more different types of packages begun to appear on store shelves with the neck bands but the marketers of such products have caught onto the idea of printing selling language on the band - in effect, making it a part of the marketing graphics.

Shrink bands are certainly not the only tamper-evident device on the market, as PACKAGING'S 'Quick Reference Chart' shows. Some experts predict that chemical indicators, such as oxygen sensitive dyes, may soon make most mechanical devices obsolete. But none of these technologies will protect the consumer unless he or she is trained to look for the presence - or - absence of such devices.

SHOPPERS CANNOT TELL TAMPERED PACKAGES FROM UN-TAMPERED PACKAGES

Consumer Education

'Consumers must become active participants in deterring and preventing crime tampering, and can do so if fully informed'.

Yet many observers of the tamper-evident conversion process believe the most important work lies ahead - educating the consumer to recognize signs of tampering.

Packaging consultants point out the inability of many consumers to tell tampered packages from un-tampered, adding if (tamper-evident) devices are not conspicuously, obviously and prominently signalling evidence of a package break-in to shoppers, that they cannot be called tamper-evident in the true sense.

Clearly, whatever tamper evident technologies achieve dominance in the 1990's, they must do a better job of communicating that tamper-protection to the consumer. Otherwise a great deal of time, effort and research dollars will have been wasted - and shoppers may be no better protected than they were before.

Neck bands and shrink labels have led the way in conversions to tamper-evident packaging for food and personal care products, by adding a decorative graphic touch.

HYGIENE

The spotted appearance of the inside of cans made of tin plate, which is frequently observed, is due to organic sulphur compounds - the formation of iron sulphide. With plastic containers however it is important to see that no soluble components of the softener (perhaps fat soluble toxic substances) pass into the food.

Storage and shipping cannot be done together with poisonous substances, such as certain pesticides. Insufficiently sterilized food may contain a large number of germs, abound in sport-forming flora and will cause cans to bulge. This is due to lack of cleanliness of raw materials, machines, processing tables or receptacles. Also personnel affected with infectious diseases or excreting disease germs (so-called excretors of germs) must not be employed in food processing plants.

Particularly dangerous sources of infection are botulinus bacteria and salmonellas. Botulinus germs are found in the soil and they are anaerobic. Salmonellas are fairly common and are found in food of animal origin. Above all on meat, dried egg and dry albumin. They can also be found on grated coconut and spices. The germs can also be communicated by contact through human beings, animal or contaminated means of transport.

Frequently, contaminated water on the islands, particularly ground water contaminated by surface water or sewage, is the cause of large-scale incidence of salmonellosis (typhoid infection). Therefore, the water used in food processing plants of all kinds must continually be examined bacterio-logically.

When is Food regarded as Adulterated?

Food is regarded as adulterated if it is similar to the

general natural food, both as far as its external appearance and the results of an organoleptic test are concerned, without being identical in composition to the natural product. With identification which is adequate, adulterated food can also be placed on the market. But the usual customs in the trade may not be infringed thereby.

- When is food diminished in its nutritive value, capacity to please, or usability?
If essential ingredients have been removed, if during the processing, substances which reduce the value have been left in it, for example:

- Stems and stalks in canned vegetables, stalks and shell components in spices; inadequate maturity; foods stored for too long periods; deep freeze goods which are re-frozen.

With adequate identification, even goods which are reduced in value can be placed on the market (eg. fruit with bruised points, nuts from old harvest). But an active admixture of goods of reduced value would not be permissible even with identification. On the other hand, coffee from which the caffeine has been removed can be marketed with the designation 'free from caffeine'.

- When is a food apt to give the appearance that it has better properties?

Of importance in this connection is the external appearance of the food. i.e. the printing on the package, the illustration and overall impression which the statements on, and the appearance of the packaging creates in the buyer. Food is mislabelled if it is provided with a false name or offered for sale under a label bearing incorrect statements as to quality or false advertising claims. This is particularly true in the case of illustrations which do not correspond to the actual contents of the package.

Examples:

Prominently displaying selected fruit of above-average quality in cellophane packages containing dried fruit; packages with excessively thick cardboard inlay or with a false bottom; coloured cellophane packaging (insofar as the appearance of a higher quality of dissimulated by the colouring).

Not permitted are statements or illustrations emphasizing properties with which the food product concerned is endowed by nature or which must correspond a priori to

the legal requirements.

- **The Prohibition on placing on the market commercially Foods which are not suitable for Consumption is Comprehensive:**

This ban refers not only to foodstuffs as such, but also to consumer goods (#5 of the Food and Consumer Goods Law) which are intended during the production, treatment, marketing or the consumption of the food to come into contact with, to the extent that substances which endanger health may be transferred to the food concerned. (Technical properties of the production installations, type of the packing materials, e.g. cans which are sensitive to corrosion, chemical and physical nature of synthetic materials).

This prohibition also extends to the special provisions with respect to radiation, use of plant protection, storage protection and insecticide agents and to the use of substances having pharmacological effects in the foodstuffs sector.

- **When is food tainted?**

Food is regarded as tainted if it has been so seriously affected by changes in smell or appearance, soiling, signs of fermentation, adverse fermentative action, vermin, improper preparation (for example, excessive salting) or storage that, according to the prevalent view, it is no longer suitable for human consumption or evokes aversion. Particularly strict standards are applied in evaluating such goods as tea and coffee. In such cases even reduced capacity to please causes the goods to be regarded as tainted.

Examples:

Mouldy nut kernels, rancid fat, bulging cans, fermenting fruit juice, stale meat, maggoty cheese, flour having a rank smell, dried fruit infested with mites, wine that has turned sour, food damaged by insects or rodents.

An import shipment of nuts with more than 20% (in number) mouldy, empty or rancid nuts is regarded as tainted and as constituting a violation of food regulations. The use of a tainted ingredient in food processing causes the finished product to be tainted, even if it appears to be unobjectionable.

- **Protection provided by the Food Law against deception:
It is forbidden to:**

1. Place on the market foodstuffs which are unsuitable for consumption or foodstuffs which have been reproduced or treated contrary to the regulations under #31 as foods for commercial purposes.
- 2a. Adulterated foodstuffs,
 - b. Foodstuffs which differ from the interpretations of the trade with respect to their properties and therefore in their value, especially in their nutritional or luxury goods value, or which have been substantially reduced in their usefulness or;
 - c. Foodstuffs which are suitable for giving the impression of better properties than their actual properties, or to place foods on the market without adequate identification;
3. Permitted additives or permitted radiation, even when identified, may not be used in such a manner that they are suitable for misleading the consumer about the reduced value or the reduced usefulness of a food.
4. In commerce with foodstuffs which contain the permitted additives or residues of substances in the sense of #14 and #15 or which have been subjected to a permissible radiation process or in advertising in general or in individual cases, use may not be made of designations or other indications which suggest that the foods concerned are natural, naturally pure or free from residues or harmful substances.
5. Foodstuffs may not be placed commercially on the market with misleading designations, indications or packing, not may advertising be affected for foods in general or in individual cases with misleading illustrations or other statements. Deception is present in particular when:
 - a. foods are accompanied by effects which are not attributed to them in the lights of scientific knowledge or which are not adequately supported scientifically
 - b. when designations, indications, presentation, illustrations or other statements suitable for deception are used concerning the origin of the foods, their quantity, their weight, the date of their manufacture or packaging, their shelf

life or concerning other circumstances which are co-decisive for their evaluation

- c. when foodstuffs are given the appearance of a pharmaceutical.

This is also true of one-sided and even more so-exaggerated emphasis on nutritious qualities, alleged wholesomeness or the suitability of the product for certain purposes, for example, dietary ones. If reference is made to a particular property or quality, the goods must need above-average requirements.

Apt to be deceptive are not only the type of the external presentation, including the typeface size and the portrayal of labels, but also statements on the origin, amounts, weight, harvest, packing and storage life data.

Thus an indication of 'natural' or 'naturally pure' in the case of products which contain (permissible) residual amounts of plant protection agents would be misleading.

Any misleading information can bring heavy fines of up to US\$25,000. This we do not want to happen. Therefore, detailed research and basic information concerning FOOD and PACKAGING LAWS are an essential ingredient for a successful export business.

COMMODITY PACKAGING REQUIREMENTS

The packaging requirements and sizes for a range of agricultural products presently exported to extra-regional markets are given below. Variation in market requirements exist between different importing countries and individual markets and buyers within each country. The details should therefore be regarded as examples which do not necessarily apply to all market situations.

Avocado: single layer carton at r-6 kg; two-piece full telescopic or one piece self-locking; internal packaging advisable. Internal dimensions; 34 x 26.9 x 10.9 cm.

Breadfruit: full telescopic two-piece ('banana' type) carton or one-piece waxed self-locking (1 1/9 bushel carton); can be single layer or double layer; packed to specific weights of 10-16 kg. depending on the carton. Internal dimensions: 51 x 34 x 20 cm or 44 x 29.5 x 29.5 cm.

Coconut: woven plastic sacks (20 count) or full telescopic two-piece ('banana' type) carton (15-25 count). Internal dimensions: 51 x 34 x 20 cm.

Dasheen: full telescopic two-piece ('banana' type) carton or waxed one-piece self-locking (1 1/9 bushel carton) packed to 12-18 kg. Polythene film liner and damp wood shavings included. Internal dimensions: 51 x 34 x 20 cm or 44 x 29.5 x 29.5 cm.

Eddoe: full telescopic two-piece ('banana type') carton, packed to 12-18 kg. Internal dimensions: 51 x 34 x 20.

Sweet Potato: full telescopic two-piece or one-piece self-locking waxed carton ('banana' type or 1 1/9 bushel) packed to 12-18 kg. Internal dimensions 51 x 34 x 20 cm or 44 x 29.5 x 29.5 cm.

Water coconut: woven plastic sacks (10 count).

Watermelon: full telescopic two-piece carton ('banana' type) packed to 12 kg. or single-piece carton packed to 23 kg. (dependent on the type and size of watermelon). Internal dimensions: 59.5 x 48 x 31 cm. or 51 by 34 x 20 cm. or 53 x 36 x 22 cm.

Yam: full telescopic two-piece carton ('banana' type) or one-piece waxed self-locking (1 1/9 bushel) packed to 16-18 kg. Internal dimensions 51 x 34 x 20 cm. or 44 x 29.5 x 29.5 cm.

Egg plant: one-piece self-locking waxed carton (5/9 or 1 1/9 bushel), full telescopic two-piece carton ('banana type') or two-pieced full or half-telescopic smaller carton ('vegetable' type) packed to 5-9 kg. Internal dimensions: 44 x 29.5 x 29.5 cm. or 51 x 34 x 20 cm. or 37.7 x 28 x 16 cm.

Ginger: one-piece self-locking waxed carton (1 1/9 bushel) or full telescopic two-piece carton ('banana' type); packed to 12-15 kg. Internal dimensions: 51 x 34 x 20.

Hot pepper: two-piece full or half-telescopic cartons preferable, packed to 4-8 kg. (larger 'banana' type cartons should include central divider support). Internal dimensions: 40 x 31.5 x 14.5 cm or 51 x 34 x 20 cm.

Mango: single layer two-piece full telescopic or one-piece self-locking carton packed to 4-5 kg. Internal packaging advisable (shredded paper, individual tissues). Internal dimensions: 34 x 26.9 x 10.9 cm. 'Pickling' or 'sucking' mangoes should be packed in full telescopic two-piece carton ('banana' type) with central divider support or one-piece waxed self-locking cartons (5/9 or 1 1/9 bushel) to 12-15 kg. Internal dimensions: 51 x 34 x 20 cm. or 44 x 29.5 x 29.5 cm.

Melons, Cantaloupe, Honeydew: one-piece full or half telescopic single layer carton; packed to 5-10 kg. depending on the carton; internal packaging advisable (shredded paper). Internal packaging: 40.6 x 33 x 11.8 cm.

Okra: shallow cartons, full or half telescopic two-piece, packed to 3-5 kg. Internal dimensions: 37.7 x 27.9 x 16 cm. or 34 x 26.9 x 10.9 cm.

Plantain: full telescopic two-piece carton ('banana' type) with central divider support, packed to 13 kg. Internal dimensions: 51 x 34 x 20 cm.

Pumpkin: mesh bag packed to 23 kg. or single-piece cartons with divider support packed to 23 kg. Internal dimensions: 59.5 x 48 x 31 cm.

INTERNATIONAL MARKET REQUIREMENTS FOR SOME SELECTED COMMODITIES

Passion fruit: Passion fruits are sensitive to desiccation and at the same time need much ventilation. They should be cooled immediately after harvesting and kept at 7-12°C throughout storage and transport. Optimum transport depending on cultivar, source and storage duration. The relative humidity should be kept at 90-95 % throughout transport and storage. Passion fruits have a very high ethylene production rate and a high sensitivity to ethylene. They are transported by air. No international standards have been issued on the storage and transport of passion fruit.

Package and quality requirements: Passion fruit packages should be constructed to allow for good ventilation. Packages containing approximately 1.7 kg., which corresponds to 40-48 fruits, are generally accepted. Some importers accept larger units. Passion fruits are either jumble packed, arranged in one or two layers, or packed in cells in one layer. They usually require approximately 6 litres internal volume for packaging of approximately 1.7 kg. No international standards have been issued specifically on the quality of passion fruit. Irrespective of this the fruits should be fresh and homogenous in each package in respect to origin, size, colour, ripeness, etc.

Labelling: Handling information

- This side up-symbol

- Temperature-symbol with indication of temperature range: minimum 7-12°C, maximum 9-14°C, depending on cultivar, source and storage duration

Produce information indicated on 'produce short side'

- D - Origin: Country
Locality, if relevant
- D - Produce: PASSION FRUITS - FRUITS DE LA PASSION
- D - Net
Weight: Net contents in kg.
- Count: When arranged in layers: indication of the number of fruits in the package
- Packed: Date of packing, open or in code

Other labelling on 'produce short side'

- Tare: Tare weight in kg
Maximum \pm - deviation in per cent
- D - Packer or
Dispatcher: Name and address or authorized code
- Grower: Name and address or code.

Papaya: Papayas are very sensitive to impacts and to compression. Therefore packaging must be able to absorb all stacking and compression stresses during transport and storage. Injured fruit should be removed immediately as bruises will result in rapid breakdown and subsequently rot development occurs. Rot then spreads quickly to other fruits. They are highly susceptible to fruit fly attacks. Papayas are temperature sensitive. The optimum storage temperature is 7-10°C depending on cultivar and stage ripeness. The respiration heat is low, but strongly temperature dependent. The relative humidity should be kept at 85-90% throughout transport and storage. Papayas have a high ethylene production rate and are highly sensitive to ethylene. Due to their short shelf life, 1-2 weeks, papayas are transported exclusively by air. No international standard has been issued on the storage and transport of papayas.

Package and quality requirements: Packaging for papayas should be constructed to allow for good ventilation. Inserts are normally not used in packaging, however, in order to improve the stacking strength a Z or H type insert in full height may be included. In order that bruising be prevented, it is recommended that each fruit be wrapped in tissue paper and cushioned with paper wool, wood wool or similar materials. Papayas are packed in one layer only in the package. There is a market preference for units for 3.5 to 4 kg net, containing a variable count of fruits depending upon size. Four kg. of papayas requires approximately 11 to 12.5 l of internal space. No international standards are issued

specifically on the quality of papaya. Irrespective of this the produce should be homogenous in each package in respect to origin, variety, size, ripeness, etc.

Labelling: Handling information

- This side up-symbol
- Fragile-symbol
- Temperature-symbol with indication of temperature range: minimum 7-10°C, maximum 9-12°C, depending on cultivar, and stage of ripeness.

Produce information indicated on 'produce short side'

- D - Origin: Country
Locality, if relevant
- D - Produce: PAPAYAS - PAPAYES
- D - Net
Weight: Net contents in kg.
- D - Count: Number of fruits in the package
- Packed: Date of packing, open or in code

Other labelling on 'produce short side'

- Tare: Tare weight in kg
Maximum \pm - deviation in per cent
- D - Packer or
Dispatcher: Name and address or authorized code
- Grower: Name and address or code.

Mangoes: Mangoes should be cooled as soon as possible after harvesting, particularly if the fruits are required to undergo long distance sea transport. The optimum storage temperature for most varieties is 13°C. A few varieties tolerate 10°C or lower. The temperature should never fall below the figures stated, as this may result in chilling injuries. The relative humidity should be kept at 85-90% throughout transport and storage. Mango has a moderate ethylene production rate, but is very sensitive to ethylene. Due to their short shelf life, 2-3 weeks, mangoes are transported by air. Most major suppliers are undertaking trials on sea transport. Mangoes are normally picked and shipped mature. ISO has issued an international standard: ISO 6660 Mangoes - Guide to storage.

Packing and quality requirements: packaging for mangoes should be constructed to allow for good ventilation. There is a

market preference for units that are around 5 kg. net, and contain a variable count of fruits depending upon size. Precisely measured fruits can be tightly packed without inserts of cushioning, provided the stacking strength of the package is sufficient. Where inserts are used they should be full height in order to obtain increased stacking strength at a moderate cost. Cushioning such as with tissue paper underneath the fruits, is an advantage. The fruits are placed on the stem, on the side or on the face in the package according to size. They should be packed one layer only in the package. Five kg. of mangoes require approximately 8 1/2 to 9 1/2 l of internal space when packed without inserts; and approximately 11 to 13 l when packed in cell-pack form. A recommendation for mangoes has been issued by UN/UCE: AGRI/WP.1/R.142.

Labelling: Handling information

- This side up-symbol
- Fragile-symbol
- Temperature-symbol with indication of

temperature range: minimum 7-12°C, maximum 9-14°C. Varieties that tolerate lower temperatures should be marked accordingly.

Produce information indicated on 'produce short side'

- C - Origin: Country
Optional, District where grown or national, regional or local place name
- C - Produce: MANGOES - MANGUES
Produce indication is mandatory if the contents are not visible from the outside.
- C - Variety: Name of Variety
- C - Net Weight: Net contents in kg.
- C - Count: Number of fruits in the package
- C - Size: Size expressed according to the coding included in the UN/ECE recommendation.
- Packed: Date of packing, open or in code

Other labelling on 'produce short side'

- Tare: Tare weight in kg
Maximum \pm - deviation in per cent

- C - Packer or
 Dispatcher: Name and address or authorized code
- Grower: Name and address or code.

Pineapple: Pineapples from some sources of supply are grouped according to:

1. Size	Designation	Weight
	A	1500g and over
	B	1100 - 1500g
	C	800 - 1100g
	D	less than 800g
	Baby	approx. 550g

Sub-divisions occur frequently.

2. Apparent Maturity	Designation	Interpretation
	M1	fruit on the turn
	M2	half-ripe fruit
	M3	ripe fruit

Standard quality pineapples are harvested between M1 and M2 depending on fruit size, and transported by sea. Luxurious quality pineapples are harvested half-ripe/ripe and transported by air.

For standard quality the market prefers:

Size A: 8 fruits per package
 Size B and C: 12 fruits per package
 Size D: 20 fruits per package

For luxurious quality, the market prefers 6 fruits per package. Baby pineapples are preferred 18 fruits per package. Standard quality pineapples are normally shipped with reduced crown, luxurious quality with a large crown. Therefore packages (for the vertically packed fruit) for luxurious quality pineapples are higher than packages for corresponding standard quality. No international standards are issued on the quality of pineapples.

Labelling: Handling information

- This side up-symbol
- Fragile-symbol
- Temperature-symbol with indication of

temperature range: For mature green fruits: minimum 10°C, maximum 13°C. For ripe and half-ripe fruits: minimum 7°C, maximum 10°C.

Produce information indicated on 'produce short side'

- D - Origin: Country
Locality, if relevant
- D - Produce: PINEAPPLES - ANANAS
Optional: Variety
- D - Count: Number of fruits in the package
- D - Size: Size of the fruits indicated according to the commercial tradition (A-D, Baby) and/or national regulations in the importing countries
 - Maturity: Apparent maturity designations
 - Packed: Date of packing, open or in code

Other labelling on 'produce short side'

- Tare: Tare weight in kg
Maximum \pm - deviation in per cent
- D - Packer or
Dispatcher: Name and address or authorized code
- Grower: Name and address or code.

Ginger: Ginger is a durable product. In order to reduce evaporation and respiration ginger may be cooled after harvesting and held under refrigeration. the storage temperature should not fall below 13°C. For short-term holding ambient temperature is frequently used. The relative humidity should be kept at 85-90% if shipped for immediate consumption. The relative humidity should be kept at 65-70% when stored for longer periods (2-6 months) due to the risk of mould growth. some weight loss may be expected in storage at 65-70% r.h. Ginger has a low ethylene production rate and a low sensitivity to ethylene. Ginger is delivered by sea, as pallet loads or as loose packages in containers. The market for ginger consists of two distinct segments:

- the ethnic minorities who use ginger in considerable quantities in their diets;
- the native European population who uses ginger as a special flavour additive.

No international standards have been issued on the storage and transport of ginger.

Package and quality requirements: Packaging for ginger should be constructed so as to allow for some ventilation. Ginger is packed in a number of forms with respect particularly to unit quantities, in order to fulfil the diversified demands. Most importers prefer corrugated fibreboard boxes containing 5 kg. net, but importers who specialize in supplying the ethnic minorities accept wirebound boxes containing approximately 18 kg. Ginger is occasionally shipped in sacks. No international standards have been issued with respect to quality of ginger. Irrespective of this, the produce should be homogenous in each package.

Labelling: Handling information

- Temperature-symbol with indication of temperature range: minimum 13°C, maximum 15°C.
- Keep dry-symbol: Keep dry-symbol should be indicated only when the produce is intended for long sea transport and storage for longer periods.

Produce information indicated on 'produce short side'

D - Origin: Country
Locality, if relevant

D - Produce: GINGER - GINGEMBRE

D - Net weight: Net contents in kg.

- Packed: Date of packing, open or in code

Other labelling on 'produce short side'

- Tare: Tare weight in kg
Maximum \pm - deviation in per cent

D - Packer or Dispatcher: Name and address or authorized code

- Grower: Name and address or code.

Melons: Melons are highly perishable and should be handled with care throughout transport and storage. melons are bruised due to pressure as well as to impact. Consequently packaging should be constructed so that the melons are exposed neither to stacking pressure nor to mutual bruising. Melons

are sensitive to low temperatures, but sensitivity varies with variety, origin, ripeness, and storage time, eg. full ripe cantaloupes may be kept at low temperatures (2°C) for a week, whereas honeydews should not be stored at temperatures below 7-10°C and from some sources at 16-18°C. Melons should be cooled as soon as possible, after harvesting, depending on expected storage and transport duration. The respiration heat is fairly low. The relative humidity should be kept at 85-99 % throughout transport and storage. Most melons have a rather high ethylene production rate and have a high sensitivity to ethylene. Most melons are supplied by nearby countries by road or sea. Off-season deliveries are normally by air. No international standards have been issued on the storage and transport of melons.

Package and quality requirements: Packaging for melons should be constructed to enable good ventilation. Honeydew melons are sold mostly in 10 kg units with other varieties sold in smaller units, normally approximately 5 kg. net. Precisely measured melons can be tightly packed without inserts or cushioning. Due to variations in size and shape, it is normally necessary to use filling materials or compartmented trays to prevent mutual bruising during handling and transport. Wood wool, glassine wool and similar materials, or tissue paper are used. Paper wool made from printed paper and straw should be avoided due to health and phyto-sanitary regulations. Expanded plastic nets can be used instead of loose filling materials.

Oblong melons such as honeydews are most often placed on their sides in the package, whereas globose or flattened varieties are placed mostly on the bottom. As tray inserts do not add to the stacking strength of the package, sufficient strength is required by the package itself to protect the melons from bruising due to compression when trays are used for separation of the melons. Melons are packed one layer only in the package. Approximately 2 1/2 l of internal volume is required per kg of melon. The required volume varies according to size and shape. Often a 'standard' package is used for a variety of sizes and shapes. In these cases the net contents vary accordingly. International quality standards for melons are issued by UN/ECE: No. FFV-23 and by OECD: No. 38. No quality standard has been issued by EEC.

Labelling: Handling information

- This side up-symbol
- Fragile-symbol
- Temperature-symbol: the temperature range should be indicated according to the specific requirements of the variety and other particulars.

Produce information indicated on 'produce short side'

- C - Origin: Country
Optional, District where grown or national,
regional or local place name
- C - Produce: MELONS
Produce indication is mandatory if the contents
are not visible from the outside.
- C - Variety
or type: Name of variety or type
- C - Class: Class of quality according to the UN/ECE and
OECD quality classifications
- C - Net
Weight: Net contents in kg. Indication of net weight
is mandatory when 'count' is not indicated
- C - Count: Number of melons in the package
Indication of count is mandatory when 'net
weight' is not indicated
- C - Size: Indication of size by weight or by diameter of
the equatorial section of the melons.
Indication of size is mandatory if sized.
Sizing is compulsory for Class I.
- Packed: Date of packing, open or in code.

Some European "E" numbers for allowed additives.

E200-203	Sorbic Acid, Sodium Sorbate, Potassium Sorbate, Calcium Sorbate
E210-213	Benzoic Acid, Sodium Benzoate, Potassium Sorbate, Calcium Benzoate
E214-219	Parahydroxy benzoic acid ethyl ester - "PHB" esters E216
E236-238	Formic Acid
E220	Sulphur Dioxide
E221	Sodium Sulfite
E222	Sodium hydrogen sulfite
E223	Sodium disulfite
E224	Potassium disulfite
E226	Calcium sulfite
E227	Calcium hydrogen sulfite
E160	Colouring matters - state substance
E236	Amino Acid
E238	Calcium formiate - amino acid
E280	Propiomic acid
E281	Sodium propionate
E232	Sodium orfthophonyl phenol

Requirements for spices according to honest trading practices

Type of spice	Maximum Moisture	Minimum Oil Content	Ash	Maximum Sand content (part of ash not soluble in hydrochloric acid)
Cardamom (with husks) (Fructus cardamoni)		3.5 - 4%	10%	4%
Cardamom (seeds)		3.5 - 4%	7%	2%
Cloves* (Caryophylli)	12%	14%	8%	1%
Ginger (Zingiber officinal)		1.5%	8%	3%
Coriander (Coriandrum sativum)		0.3%	8%	2.5%
Caraway seed (Carum carvi)		3.5%	9%	2%
Bay leaf (Folia lauri)	8%	1 - 2%	6%	6%
Mace (Arillus myristicae)		4 - 10%	2.5%	0.5%
Nutmeg (Semen myristicae)		5 - 6%	3.5%	0.8%
Paprika powder (Capsicum annum)	sweet: hot:	0.10% 0.05%	6.5% 7.5%	1% 1%
Allspice* (Pimenta diocia)	alcohol extract:	approx. 25% 2%	6%	0.5%
Black pepper* (Piper nigrum)			7%	4%

Type of spice	Maximum Moisture	Minimum Oil Content	Ash	Maximum Sand content (part of ash not soluble in hydrochloric acid)
White pepper*			6%	1%
Saffron* (Crocus sativus)	12%	0.6%	6.5%	1%
Vanilla (Vanilla planifolia)	ether extract: approx.	5%	7%	
Cinnamon (Cinnamomum)	13%	2%	5-7%	1.8%

- * Cloves: stems not in excess of 10%
 Allspice: black fruits up to 5% stems up to 2%
 Black pepper: raw fibre up to 17.5%
 White pepper: raw fibre up to 7.5%
 Saffron: filaments not in excess of 30%

Poppyseed must not contain more than 0.05% of henbane seed.

PACKAGING COMPANIES

COMPANY	CONTACT PERSON	TEL #	ADDRESS	PRODUCT
COT Printery	Nigel Worme	427-8582	Grand Balmoral Gap, Hastings, Barbados	Colour Printing
Hi-Tech Printery	Darryl Brathwaite	440-1317	P.O. Box 436, St. George's, Grenada	4-colour Printing
Plastil Industry	Prakash Persaud	452-0529	Manisil, St. Lucia	Barrel Pails
Vinelli Industries Ltd.	Vickram Oditt	592-2- 62658	P.O. Box 101171, Guyana	Waxed Cartons
Jet Corr Packaging	Dick Kwit	813-644- 2774	Conyers, GA 30208, USA	Boxes - all types
Packaging Corpor- ation of America	Charles Pierce	617-934- 7194	Duxburg MA 02332, USA	Boxes - all types
Enso Pack	Mark Forde	425-2179	Jackson, St. Michael, Barbados	Paper Stock
Multi- media Production	Winston Edghill	427-8672 - Fax	BARBADOS	Label Design
CARIRI	Benedict Chatoor	662-7161	Tunapuna Post Office, Trinidad	Packaging Institute
Joseph Plastics	Paul Joseph	448-3228	P.O. Box 64, Fond Cole Industrial Estate, Dominica	Plastic Bags
Creative Plastics	Valentine Monish	465-6060	P.O. Box 431, Basseterre, St. Kitts	All plastic containers
ABC Containers		449-2000	Jimmit, Dominica	Boxes

COMPANY	CONTACT PERSON	TEL #	ADDRESS	PRODUCT
Finerva Cartons	Denis LaBassiere	454-6031	Vieux Fort, St. Lucia	Boxes
Printer Pack	Mark Talger	425-2179	Jackson, St. Michael, Barbados	Cigarette packs
Maurel Industries	Rich Taurel	428-4824	Christ Church, Barbados	Plastic bottles
Indriera Centro- Americano		51-2684	Cartago/Costa Rica	Glass
Island Elastics	Om Prakash	423-8102	St. Phillips, Barbados	Straw bags
Barbados Packaging Industries	John Skimmer	425-0251	Applewhaites, St. Thomas	Straw bags
Caribbean Graphic Products	Alfred Allman	429-0430	Ellerton, St. George's, Grenada	Brosch- small boxes
Caribbean Products	Edmund Atack	428-7780	Thornburg Hill, Christ Church, Barbados	Disposable pens
File-it Limited	Peter Hartman	423-7968	St. Phillips, Barbados	Binders, folders
Industrial Packaging	Bjorn Bjerckhamm	439-9897	Spring Hall, Barbados	Multi-bags
Printerman	Mark Taylor	425-0000	Jackson, St. Michael, Barbados	Collapsible cartons
Elastic Building	Richard Lynch	429-8947	St. Michael, Barbados	Containers
Essa Nicholas	Lester Johnson	429-5450	Bridgetown, Barbados	Paper Bags
etchworth Press	John Sheam	436-6170	Wildey, St. Michael, Barbados	Colour Printing

COMPANY	CONTACT PERSON	TEL #	ADDRESS	PRODUCT
Johnson Printing	Andrew Johnson	436-6304	Pleasant Hill, Christ Church, Barbados	All printing
Santainers			P.O. Box 757, Port of Spain, Trinidad	Styrofoam, cups, etc.
Rheem de Puerto Rico			GPO 4766 San Juan, Puerto Rico, 00936	Drums
Plasti-Caribbes			Quarter Plamiste, Gondeau 97232, Martinique	Shrink film
PH Vieira Plastics			P.O. Box 831, St. Vincent	Shrink film
EZEE Products			12 Production Ave, Sea Lots, Port of Spain	Bottles
Bags Limited	Guy Mayers		Grosislet, Castries, St. Lucia	

CONCLUSIONS

Now that we have heard in a very condensed form of what is coming at us, we can only estimate the urgency necessary, to do something now and do not waste anymore time in lengthy discussions and trial and error type production.

For persons who still have more questions, I suggest that you write to the following institutions. For more textbooks, information on your particular product line. On the other hand I will be glad to cooperate together with the present sponsor organisations of this workshop to organize another seminar, (theory and practical) and will at the same time elaborate more in detail on your particular needs in the Trinidad and Tobago Export Sector.

Maybe a seminar on Food Technology Transfer should be considered in order to produce the required clean, sound and legal products for export.

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Manual on the Packaging of Fresh Fruits and Vegetables: Palais de Nations, 1211 Geneva 10, Switzerland

Requirements Concerning Quality, Packaging and Labelling: German Agency for Technical Cooperation GmbH P.O. Box 5180, 6236 Eschborn

Exporting to the German Federal Republic: BfAI P.O. Box 108007, 5000 Cologne 1, Germany

Quality Norms in the European Community for Fruits and Vegetables: Verband der Landwirtschaftskammern e. V. Godesberger Allee 142-148 5300 Bonn 2, Germany

NEW DEVELOPMENTS IN PACKAGING MATERIAL FOR USE IN EXPORTING FRESH HORTICULTURAL PRODUCTS

by

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Caribbean Industrial Research Institute

INTRODUCTION

In Trinidad and Tobago the growth of non-traditional agriculture has been observed over the last ten years. Cut flowers, fruits and vegetables have been successfully exported and indications are that potential for the increase in exports exists in North American and Western European Markets. A clear understanding of what happens to the product from harvesting to consumption is very important if exporters wish to maximise the returns of their efforts. The required tailoring of the product to the requirements of the market especially where product presentation is concerned, must also be fully appreciated. With knowledge of market requirements in hand, activities such as product selection, harvesting techniques, post-harvest methods, cultivation methods, grading, transport, etc. can now be considered. Along with these, another activity called 'Packaging' would also have to be considered.

At this point, it would be useful to introduce some definitions which will help to keep the discussion focused and they are as follows:

i. Packaging

The overall concept of a co-ordinated system of preparation of goods for shipment, distribution, storage and marketing at optimum costs compatible with the requirements of the product.

ii. Packing

The operation of packaging by which articles or commodities are enveloped in wrapping and/or enclosed in containers, or otherwise secured.

iii. To Pack

- a. To put a product into a container for storage or transportation.
- b. To bale or bundle.

iv. A Package

- a. One unit of a product, uniformly processed, wrapped or sealed in a sheath or container;
- b. A quantity of items boxed or wrapped for storage and shipment;
- c. A container in which a produce is packed.

v. To Package

To make up a package.

From this it can be seen that the package is critical to the whole exercise of packaging. Package design and construction have and will continue to be areas where improvements are on-going processes. Materials used in package construction are also being improved and new areas are being developed to try and satisfy all criteria in the definition of packaging. In this paper, we will focus on the dominant materials used and some new developments in these materials with respect to export of horticultural products.

PACKAGING MATERIALS

Wood

Wooden boxes and crates have been used successfully as export packaging for many years. Natural wood and industrially manufactured wood-based sheet materials have been used. These packages are usually used in the containerized cargo, strapped on pallets for sea transport. Some countries also use wood in packaging for air freight. The timber used must be inexpensive and easily worked to produce thin strips. This is usually done by peeling. The timber must also be lightweight and dried to prevent cracking and mould growth. A smooth surface is also desirable to minimise bruising of the product. The more commonly used species are pine and poplar which are not indigenous to Trinidad and Tobago.

Manufactured wood based sheet materials include plywood, hardboard and particle board. Plywood and hardboard are not produced locally and have other limitations when used in wooden packaging. Splintering in the case of plywood and deformation due to moisture absorbency at high relative humidity in the case of hardboard are some of the problems encountered. Particle board is rigid but relatively brittle and the appearance can alter depending on the materials used in its production. The availability of locally produced particle board is unlikely to occur in the immediate future and supplies will have to be imported. Similarly, local species of natural wood need to be identified as a resource base for a wood package industry and the sawing, slicing and

peeling facilities will need to be established. It must be noted that a significant number of items are currently exported from tropical countries in wooden packages and are also used within the Western European and North American markets.

Nails, staples and wire stitching are used to assemble the wooden boxes and these materials must be galvanized or otherwise protected to prevent rusting. A new development in the wooden package area is the advent of wire bound boxes. The wood content and hence the weight can be substantially reduced and the durability of the box kept at a satisfactory level.

On the domestic scene, we are more familiar with imported wooden packages; our use of wood has been restricted to pallet construction and field handling containers.

Paper Board

Corrugated fibre board, fibre board and paper are used to produce a wide variety of shapes and designs of boxes, liners and bags respectively. Singlewall and doublewall corrugated board with various flute designs are available. The quality of material used to produce the corrugated board boxes is critical to box performance and has been one area of development in this industry. The basis weight of the paper used is important and although unbleached, virgin coniferous draft is the most appropriate for liner materials other forms of paper have been tried depending on the package performance requirements. This material must have high tear resistance and stiffness and a low rate of moisture absorption from the air. Other materials in the use are materials based on waste paper, straw bagasse, bamboo, etc. However, high humidity is a problem with these materials because they degrade at different rates on exposure. Coatings of wax and polyethylene have helped to improve the performance of these materials but represent additional costs. The flutes are also critical to the mechanical performance of the corrugated material. The use of lower grade materials has also become commonplace where the highest performance is not required. Careful consideration should be made of the properties which are usually quoted as the puncture resistance, burst strength and compression strengths for corrugated material.

The introduction of filler materials between the liners has also improved the strength and moisture resistance of the corrugated material. Paraffin or other resins impregnated into the paper and injected into the space between the flutes has also been used to improve the durability of the corrugated material particularly where moisture is a problem. Impregnated (not coated) corrugated board is not available locally. However, it can be imported from U.S.A. and soon from Guyana.

Resin injected corrugated is available locally and is being used to provide thermal insulation in addition to better corrugated

durability.

Additional improvements have been occurring in the glues and staples used to assemble the corrugated boxes. Water resistance of the adhesives has been a long standing problem and staples are normally used. Where high volume assembly occurs, improvement in the glues is very important.

Re-cycled paper trays and inserts are very commonplace in the packaging of horticultural products. Waste shredded paper is also gaining in popularity but care has to be exercised in the selection and use of these materials since they are not suitable for all products.

Plastics

In the horticultural export trade plastics have not been a dominant material as has paper. However, growth has increased with the main uses being bags, wrappers, films and trays. Although jute sacks are still widely used they are being replaced by synthetic materials due to cost factors, appearance, mechanical properties and the reduced risk of infestation and the spreading of insects. Woven polypropylene sacks and other forms of open mesh knitted sacks are also widely used. Multi-ply paper sacks have also cut out a niche in the market place and compete with the woven or knitted polypropylene sacks and the perforated polyethylene or other plastic sacks.

Strapping materials, tapes and adhesives are other important growth areas where plastics are used and a wide variety and combination of plastic materials are used in the manufacture of these products.

By far, the largest area in the horticultural export business is the development of films of various types for wrapping sealing strapping and lining. The focus of development work in the past has been the production of breathable films which allow oxygen, carbon dioxide and ethylene levels to be controlled. Movement of these gases, as well as the use of inert atmosphere packaging and vacuum packaging are some of the areas where considerable development efforts have been made. There is however, the need to appreciate that different products in the horticultural export trade have specific microclimates which will be best suited to maintain good quality. Films wrapped over stacks on a pallet as is done with shrink film and films combined with special trays are becoming increasingly important in the export of horticultural trade. Trays and liners as well as inserts have been constructed from plastic materials such as expanded polystyrene. Many other resins are too expensive for single use situations.

Generally, plastic materials in packaging are faced today with perhaps their greatest challenge i.e. the protection of the

environment. Packaging accounts for approximately 30% of all solid waste by weight and 34% by volume of all solid waste in the US. Most of this solid waste goes to landfills where it is expected to degrade. Polyethylene, polyvinyl chloride, polystyrene, polyethylene terephthalate (PET) to name a few do not degrade and are expected to remain in landfills for many years to come. Recycling is extremely difficult because of the multi-layered (laminate) materials used and the variety of grades and modified compounds employed. Incineration is also used to dispose of these materials however, 'ozone unfriendly' emissions and toxic fumes are produced posing another set of environmental problems. This has led to the re-emergence of cellophane as a packaging material since it is made up of natural polymer cellulose, a component of plant tissue. The challenge facing the packing industry where plastics are concerned is to produce more environmentally friendly yet functional low cost materials. As the laws and restrictions are introduced in the developed countries, exporters need to be aware of these developments since they will be the first group to feel the effects of those regulations.

CONCLUSION

In the export of horticultural products careful consideration of the packaging to be used cannot be overstated. By extension, the appropriate materials must also be carefully considered and their impact on the quality of the package appreciated. Measures should be taken to ensure that the appropriate materials are in fact supplied and testing of these materials conducted. A clear understanding of the entire chain in the product life must exist before and selection of package and packaging materials is considered. The product requirements and delivery quality or end-user requirements must be also be considered in this process of package design and package material selection. These are not 'mind boggling' considerations and there has been and will continue to be successful export of horticultural products from Trinidad and Tobago and other territories in the region. However, exporters must always be on the look out for new developments and special considerations and regulations which are being put in place. This paper has attempted to provide an overview of the packaging materials scene, which remains a changing and very diversified area.

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**CARIBBEAN FARMERS DEVELOPMENT COMPANY LIMITED (CFDC)
HISTORY AND ORGANIZATIONAL STRUCTURE**

by

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BACKGROUND

In March 1986, the Organization for Rural Development (ORD) convened a meeting of farmer organizations in St. Vincent to discuss the problems of production and marketing of agricultural commodities produced by small farmers. About the same time the Inter-American Institute for Cooperation on Agriculture (IICA) carried out a comprehensive study of the fruit sub-sector in Windward Islands, giving particular attention to the needs of farmer organizations. In December 1986, IICA sponsored a meeting of representatives from ORD (St. Vincent), Farm-to-Market (Dominica) and the St. Lucia Association of Farmers Co-operatives (STAFCO-OP) to discuss the feasibility of joint marketing of agricultural produce within the region. This meeting concluded that joint marketing between farmer organizations was both desirable and feasible and should be initiated as a pilot project.

In January of 1988, IICA, in collaboration with the respective Ministries of Agriculture, initiated the four year project "Strengthening of Farmer Organizations in the OECS". The IICA project has four basic components:

1. generation of decision making information;
2. project identification/formulation/design of strategies;
3. selective training to overcome specific constraints, and
4. inter-island exchange of information and experiences.

On March 7-8, 1988, the first meeting of what was to become the Inter-Island Steering Committee of Farmer Organizations (ISCFO) was held in Dominica. Out of this conference came the call for a short-term, action oriented, plan which would serve as the pilot phase for a longer term, more comprehensive, joint marketing venture. During this meeting, attended by representatives of farmer organizations from the four Windward Islands, decisions were taken to establish a Steering Committee to design and follow up on joint production/marketing activities.

Soon after the meeting in Dominica, a technical committee prepared the "Inter-Island Joint Marketing Project" which was submitted to the Canada Fund by the ISCFO (via STAFCO-OP) in April 1988. In early 1989, the Canada Fund approved and disbursed EC\$100,000 to STAFCO-OP who agreed to administer the fund on behalf

of ISCFO.

Between March 1988 and March 1990, the ISCFO met seven times, in different islands, to monitor and evaluate on-going actions and to plan new production and marketing initiatives.

On May 10, 1990 the ISCFO was legalized as "The Caribbean Farmers Development Company Limited," incorporated under the Companies Act in St. Lucia.

RATIONALE FOR JOINT MARKETING

Farmer organizations feel strongly that the production of crops and livestock should be based on market opportunities and that farmers must play an active role in the identification and exploitation of these opportunities. In group discussion in Dominica in March 1988, representatives of numerous OECS farmer organizations stated that joint marketing should be predicated on the following:

1. Agriculture is a traditional and continuing source of economic activity within the sub-region and the backbone of this sector is the small farmer;
2. Production and marketing strategies should be closely integrated and based upon market potential;
3. Joint activities should be undertaken which enhance the capabilities of the people of the sub-region to produce and market produce for the sub-region;
4. Active farmer participation in the definition of priorities of production and marketing for export is a key to ensuring successful production/marketing programs;
5. Joint agricultural marketing through farmer organizations is complimentary to national and OECS initiatives towards diversification;
6. Joint marketing activities will contribute to crop diversification and vice versa;
7. With the spectre of the removal of preferential treatment for Windward Islands Bananas in 1992, farmer organizations must play a more active role in the search for sustainable production/marketing opportunities;
8. Jointly, farmer organizations can maintain a greater degree of control over the production, shipping and marketing of their produce;

9. Farmer organizations participating in the CFDC have voiced their support and demonstrated their commitment to the concept of joint marketing.

CFDC STRUCTURE, OBJECTIVES AND RESOURCES

Members

Members of CFDC shall be farmer organizations in the individual States of the Commonwealth Caribbean which are engaged in the production, or trading, or marketing of agricultural produce and/or implements and farm inputs.

Board of Directors

The business of CFDC shall be managed by a Board of Directors to consist of directors appointed by organizations of each of the Member States. Where the State has one organization it shall appoint one director; where it has more than one organization, or an umbrella organization with more than three hundred farmers, it shall appoint two directors.

Staffing

The Board of Directors shall appoint a General Manager, or a General Manager/Secretary or a Secretary and a Financial Comptroller. Other staff will be appointed as required and resources permit.

Meetings

Regular meetings of the Board of Directors will be held every six months. The company shall in each year hold an annual general meeting of all members. The Secretariat may call special meetings from time to time as determined necessary to conduct company business.

Objectives

The objects for which the company is established are:

- a. To develop in those Commonwealth Caribbean States where members reside, viable and self-reliant farmer organizations capable of engaging in activities and executing programs aimed at reducing the imbalance of agricultural commodity trade among and between the Commonwealth Caribbean States and other countries;
- b. To concentrate on the identification and implementation of projects and actions which will impact favourably on the reduction of food imports from sources other than the

Commonwealth Caribbean and to increase agricultural export from the States of the Commonwealth Caribbean to other countries.

Resources

In addition to its staff, technical assistance will be provided to the CFDC from Peace Corps Volunteers stationed in the member States and short term consultants provided by the IICA project to strengthen farmer organizations.

Funding for the execution of CFDC sponsored activities come from several sources including IICA, Canadian Cooperative Association, Canada Fund, Canadian Small Project Implementation Facility, Inter-American Foundation, Caribbean Association of Industry and Commerce and others.

ACHIEVEMENTS

Within a period of approximately two years (March 1988-May 1990) the ISCFO/CFDC has made considerable progress. The highlights of these achievements to date are listed below:

- The Caribbean Farmers Development Company, Ltd. (CFDC), representing 14 farmer organizations from 6 islands, was developed during 1988-89 (ISCFO) and registered in St. Lucia on May 10, 1990;
- A project for inter-island trade was funded (EC\$118,000) by Canada Fund and executed in 1989;
- Fourteen shipments of fresh produce from farmer organizations in St. Lucia and Dominica to farmer organizations in Antigua and Barbados were made successfully by members of CFDC (ISCFO) in 1989;
- The CFDC has been selected to sit on the Management Committee of the OECS Agricultural Diversification Coordinating Unit (ADCU);
- Funding (EC\$268,000) was provided by the Canadian Cooperative Association to identify and formulate development projects and to determine needs for training to strengthen farmer organizations;
- Project for the establishment of a slaughterhouse in St. Lucia, to be operated by Stafco-op, was prepared and approved for funding (EC\$593,000) by CIDA - SPIF;

- Project for the development of marketing infrastructure for the Co-operative Farmers Association, Antigua, was prepared and has been funded (EC\$56,000) by Inter-American Foundation;
- Project for the expansion of marketing infrastructure of the Barbados Agricultural Society was formulated and has been approved for funding (EC\$80,400) by Inter-American Foundation;
- Project for the expansion of marketing infrastructure for Productive Farmers Union, Grenada, was formulated and approved for funding (EC\$67,000) by Inter-American Foundation;
- Project for the development of marketing infrastructure for Sunshine Harvest Farmers Co-operative, St. Lucia, was formulated and approved for funding (EC\$67,000) by Inter-American Foundation;
- Project for the institutionalization of the Caribbean Farmers Development Company Ltd. was formulated and has been approved for funding (EC\$134,000) by Inter-American Foundation and IICA;
- A regional newspaper "Focus on Integrated Rural Development" has been created with funding (EC\$150,000) provided by the Canadian Co-operative Association and IICA and 8 issues have been published and distributed to date (3,000 copies each issue);
- Market opportunity studies have been undertaken in Barbados, Antigua, Miami and Toronto;
- North American market opportunities for organically grown produce have been evaluated;
- Publication of a series of documents providing baseline information on farmer organizations in Antigua, Dominica, St. Lucia, Grenada and St. Vincent;
- Elaboration of a strategy for the development of the livestock industry in Grenada;
- Preparation of databases for the monitoring of eggs, broilers and pork in St. Lucia, import substitution crops in St. Lucia and the collection and analysis of on-farm decision making information in St. Vincent (ORD); these databases have been put in operation and are presently being tested;
- A regional information network (Fax machines and Focus newspaper) has been initiated to facilitate communication between farmer organizations in different islands;

The achievements indicated above are the result of close cooperation and coordination between the respective Ministries of Agriculture and a diversity of regional and international development organizations including: Canadian Co-operative Association, Inter-American Foundation, IICA, SPIF, Peace Corps, Canada Fund, OECS-ADCU, and others.

FUTURE

The development of CFDC is well on its way to achieving its objectives. By involving the farmers themselves in the decision making process, and in the identification and design of solutions, it is expected that CFDC will contribute greatly to the achievement of national goals in respect to both import substitution and export development of non-traditional commodities. However, it is recognized that neither farmers nor farmer organizations can, by themselves, have much impact on rural development - the ultimate goal. The solution lies in a joint effort between farmers, farmer organizations, public sector institutions, private sector entrepreneurs and regional and international support organizations.

One of the strategies to obtain development resources has been to use CFDC to bridge the gap between funding agencies/NGOs and primary societies. This has led to an increase in the flow of resources directly to the primary societies. Emphasis has been given to the development of managerial and self-sustaining potential by assisting in the improvement of the marketing capabilities of the farmer organizations. Efforts in these two areas will continue in the future.

At the present time a project for joint marketing between marketing boards and farmer organizations (belonging to CFDC) to test niche markets in North America is being discussed with key participants. Additionally, a project to provide technical assistance to train managers of farmer organizations is being negotiated with CAIC. Information systems and marketing infrastructure is being put in place to facilitate inter-island trade with active participation of farmer organizations.

**INTERNATIONAL MARKETING OPPORTUNITIES FOR
FRESH FRUITS AND VEGETABLES**

by

**Michael Joseph, Marketing Officer
Export Development Corporation**

Agricultural exports are not new to Trinidad and Tobago, indeed they have been closely linked to the general economy of the twin island state. In the pre-oil boom era, cocoa, citrus and sugar cane were major contributors to the national well being. That era has passed and now petroleum is the mainstay of the economy. This position is not static, however, and the flush of wealth which characterized the early days of the oil boom has since passed. The economy is slowing down to realistic levels, the vulnerability imposed by a single commodity economy is unacceptable. All sectors must now contribute to the national coffers and once again agriculture is poised to do just that.

The new agricultural export thrust is not based on the traditional commodity crops but on the non-traditionals. What started around 1984 - 1985 worth just a few thousand dollars has now five years later blossomed into a million dollar industry. While this development may seem impressive, it is the view of the Export Development Corporation that it represents only a tiny portion of the nation's true potential. One of the E.D.C.'s function is to assist in the development of this potential. We see this as essential for the improvement of the country's economic well being.

Exporting is risky business, the exporting of perishables even more so with many pitfalls which with some thought and preparations can be avoided. The E.D.C. has always stressed that in order to avoid the pitfalls and ensure that the industry develops a thorough understanding of the export market environment is essential.

An in-depth study of the international export market is beyond the scope of this presentation, instead a broad overview of the world market will be first presented, then Trinidad and Tobago's position in this environment. In this paper, the 'world' should be understood to be North America and Europe. The rationale is simple, these are the largest markets for tropical fresh produce and have direct commercial air links with Trinidad and Tobago.

THE WORLD MARKET FOR SELECTED TROPICAL FRESH PRODUCE : AN OVERVIEW

The most popular tropical fresh produce items on the metropolitan markets at present are: Pineapple, Avocado, Mango and Papaya. This situation is subject to change due to market forces

but these species are good indicators of the state of the markets. Although this list may seem very short, one must bear in mind that the market for tropicals is still relatively young. These items were curiosities before the mid nineteen seventies and generally associated with the small ethnic markets of metropolitan countries. Notwithstanding the humble beginnings, the growth of this sector has been phenomenal (Table I).

TABLE I
IMPORTS OF TROPICAL FRUIT INTO EUROPE: GROWTH
% INCREASE IN IMPORTS (EUROPE)

PRODUCTS	1975-1979	1982-1986
Pineapple	44	98
Avocado	87	75
Mango	164	130
Papaya	N.A.	260

The most significant reason for this growth being the effective marketing policies of some of the major producing countries.

AVOCADO

Specifications:

Varieties: Major cultivars: Hass, Fuerte
 Minor cultivars: Ettinger, Nabal, Edrinot

Size: 150-400 grams. Median sizes most popular.
 Accurate sizing essential

Shape: Pear
 Colour: Bright Green
 Ripeness: Slightly unripe
 Taste: Smooth, fibreless

The growth and development of this market can be attributed almost entirely to the state of Israel. This country has been exemplary in their approach to the world market for fresh fruit and vegetables. The success of Avocado in the market place is a testimony to their efforts. Table 2 shows Avocado exports from selected countries for the years 1975, 1980, 1981 and 1982. With a few exceptions, most of the countries indicated have experienced tremendous growth of their avocado exports. Between 1975 and 1982, the overall growth of Avocado exports was estimated to be 242%.

TABLE 1: AVOCADO EXPORTS FROM SELECTED COUNTRIES

Country	Year (Tonnes)			
	1975	1980	1981	1982
Cameroon	422	110	188	137
Ivory Coast	270	303	825	850
Kenya	NA	835	853	817
Dominican Republic	2,086	2,750	1,137	943
Guatemala	982	10,291	NA	NA
Martinique	747	317	14	2,136
Mexico	26	956	NA	NA
Peru	-	1,512	1,627	1,341
Venezuela	-	213	625	540
United States	NA	10,268	18,747	7,486
Spain	883	1,531	2,168	2,934
Israel	15,968	15,360	18,182	37,922
South Africa	6,326	10,400	10,000	12,000
Total of countries shown	27,710	54,846	54,366	67,106

Source: The Courier

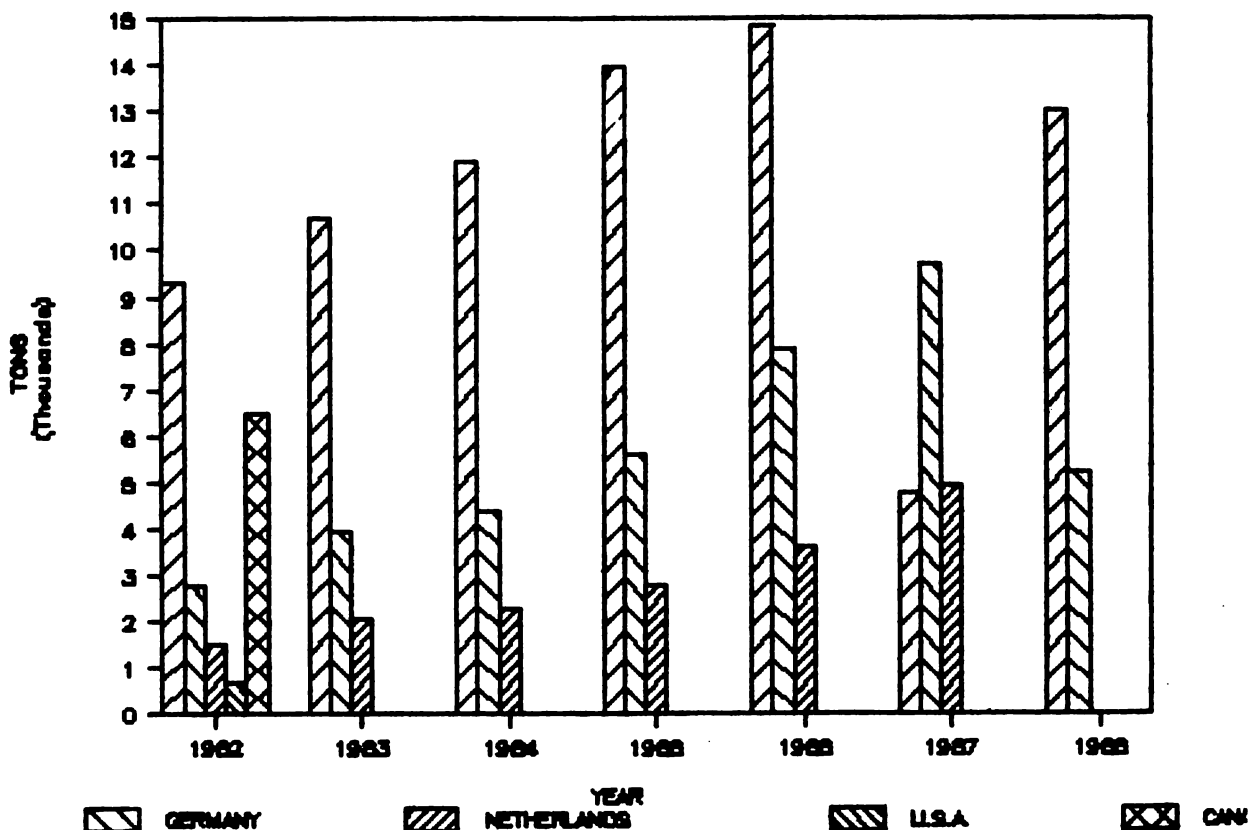
The growth of the international market for Avocado is shown in Fig. 1. The market is supplied throughout the year as indicated below:-

COUNTRY	SUPPLY PERIOD
Israel	September - April
South Africa	April - October
United States	November - July
Kenya	May - September

There are no obvious gaps to be filled in this market. Demand is highest in the summer months.

The market is expected to continue its growth trend. With increasing demand established, producers are increasing production while new producers are coming on stream. Spain, a relative new comer, is rapidly expanding its export thrust. This development should be viewed with concern by the region. As a member of the E.E.C., Spain enjoys tremendous advantages over other suppliers. This trend is likely to continue with Portugal, Cyprus and the Canary Islands entering the fray.

FIGURE 1: IMPORTS OF AVOCADO INTO SELECTED COUNTRIES



PINEAPPLE

Specifications:

Varieties: Major cultivars: Smooth Cayenne
 Minor cultivars: Queen, Red Spanish

Grades: a. Size: 1.0 - 2.0 kg. Accurate sizing is essential

Grade A: over 1.5 kg.
 Grade B: 1.1 - 1.5 kg.
 Grade C: 0.9 - 1.1 kg.
 Grade D: below 0.9 kg.

b. Colour: M1: 1/3 ripeness from base
 M2: 1/2 ripeness
 M3: 2/3 ripeness

At present the market prefers M2 - M3, Grade A - B fruit.

The major pineapple producers are shown in Table 3. Of this group, the Ivory Coast is the single largest exporter to the European Market, roughly 80%.

The U. S. market is supplied mainly by Costa Rica, Honduras and the Dominican Republic with 52%, 30% and 14% respectively. When home production is included, the potential market for newcomers becomes very small. The Canadian market is mainly supplied by the U.S., Honduras and Mexico who account for 56%, 7% and 6% respectively. An interesting feature of the Canadian market is the market share held by the group of countries termed 'other'. This group accounts for 31% of the market. The growth of the pineapple market is shown in Fig. 2.

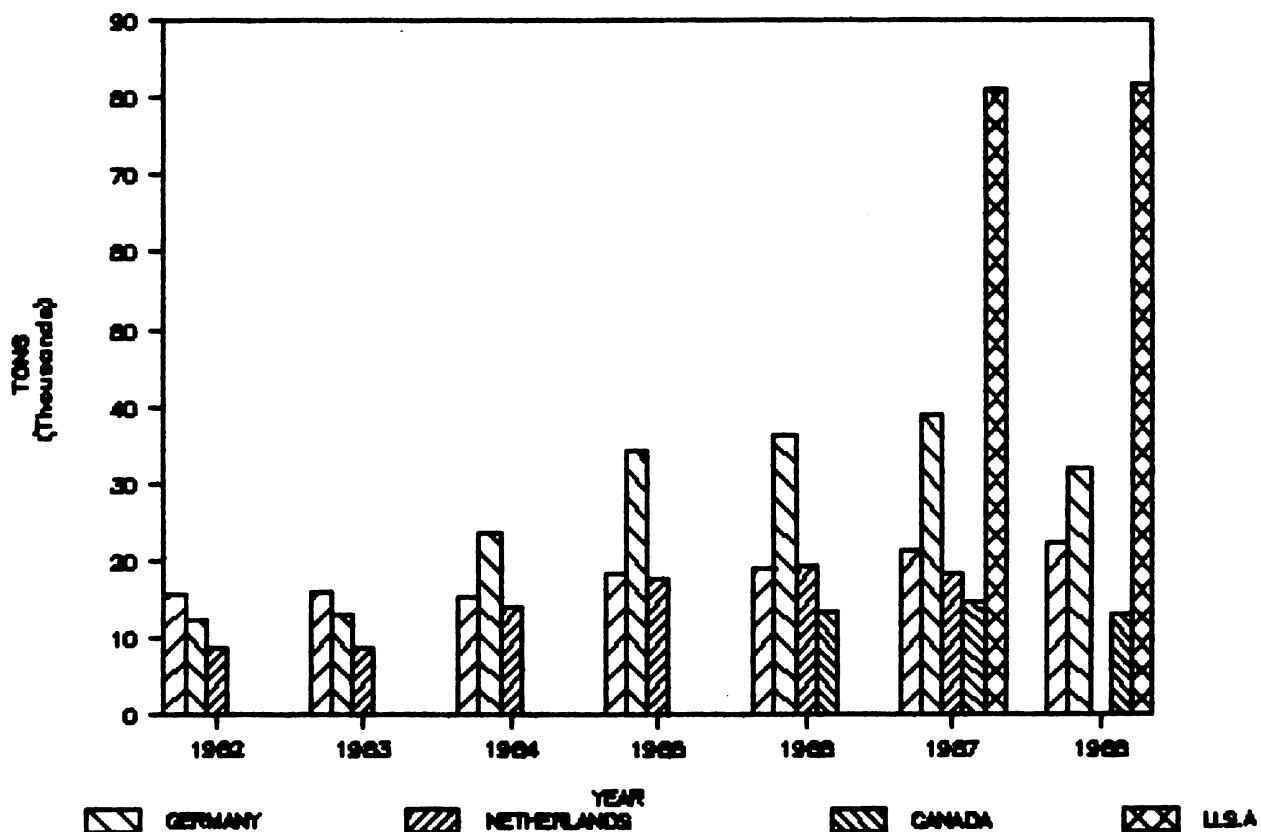
Because of the tremendous upsurge in demand indicated, all the major producers/exporters are gearing for increased production. Pineapples are produced year round, therefore, gaps in supply are not obvious. Any new supplier would of necessity have to be extremely competitive.

TABLE 3: FRESH PINEAPPLE PRODUCTION IN SELECTED COUNTRIES ('000 TONNES)

COUNTRY	1987	1988	1989
Australia	165	168	167
Ivory Coast	269	216	206
Kenya	210	191	215
Malaysia	178	195	207
Mexico	306	248	333
Philippines	1,670	1,640	1,660
South Africa	268	255	260
Taiwan	193	228	200
Thailand	1,510	1,771	1,950
U.S.A.	628	597	616
Total	5,394	5,508	5,814

Source: Fruit and Tropical Products - Commonwealth Secretariat

FIGURE 2: IMPORTS OF PINEAPPLE IN SELECTED COUNTRIES



MANGO

Specifications:

Varieties: Major cultivars: Tommy Atkins, Haclen, Keith Kent
 Minor cultivars: Alphonse, Amelie, Graham, Sensation, Zill, Julie

Grades: Size: 225-700 grams. Accurate sizing essential. Grades go from A-K increasing in 50g. steps.

Colour: Red blush most popular, but yellow is acceptable.

Texture: Free from fibre.

Ripeness: Fully mature.

Taste: No turpentine, fragrant.

There are no dominant suppliers to this market. Table 4 is an eloquent picture of the state of this market. In 1981 there were eight (8) recognized A.C.P. suppliers to the European markets. By 1983, the number was twenty-one (21) including several Caribbean countries. In addition, there are several non-A.C.P. suppliers: Egypt, Israel, India, Pakistan, Mexico, Venezuela, U.S.A., Brazil and Peru. Together these suppliers keep the European market supplied year round with the exception of the October-February period since most crops come in at summer time (Table 5).

The U.S. market is supplied mainly by Mexico and Haiti with contributions of 78.4% and 21% respectively. A recent encouraging development has been the opening of this market to mango exports from Trinidad and Tobago. The fruit must be heat treated to prevent the proliferation of pest and diseases.

There are as yet no import statistics for the Canadian market but indications are that this market is developing.

Generally, mangoes are supplied to the North American market from Florida, Mexico and the Caribbean. Central and South American countries are now beginning to feature more prominently. The supply period for the North American market is from April to September. Few mangoes are imported in the November - March period.

The overall growth of the mango market is depicted in Fig. 3.

TABLE 4: ANNUAL IMPORTS OF MANGOES, GUAVAS, MANGOUSTEENS OF A.C.P. ORIGINS

(in Tonnes)

	EUR 10	FRG	FR	IT	NL	BLEU	UK	IRL	DK	GREECE
1981										
Mali	920	41	411	4	397	49	18	-	-	-
Burkina-Faso	602	-	484	-	118	-	-	-	-	-
Senegal	143	4	89	-	40	-	10	-	-	-
Guinea	87	-	83	-	2	2	-	-	-	-
Ivory Coast	187	4	156	5	15	7	-	-	-	-
Kenya	810	190	202	18	66	44	288	-	2	-
Jamaica	103	-	-	-	-	-	103	-	-	-
Others	239	1	76	1	20	2	139	-	-	-
T O T A L	3,091	240	1,501	28	658	104	558	-	2	-
1982										
Mali	1,417	73	539	2	631	82	90	-	-	-
Burkina-Faso	1,167	-	949	-	216	2	-	-	-	-
Senegal	237	10	151	-	45	5	26	-	-	-
Guinea	173	-	50	-	33	68	29	-	-	-
Kenya	472	139	70	18	43	54	146	-	2	-
Jamaica	77	-	-	-	-	-	77	-	-	-
St. Lucia	84	-	-	-	-	-	84	-	-	-
Others	395	1	83	-	56	13	242	-	-	-
T O T A L	4,022	223	1,842	20	1,024	224	687	-	2	-
1983										
Mali	1,901	146	793	-	830	17	109	-	6	-
Burkina-Faso	1,010	20	889	-	84	3	14	-	-	-
Senegal	128	-	110	-	10	13	3	-	1	-
Kenya	566	127	109	-	38	60	220	2	10	-
Gambia	46	-	-	-	10	-	36	-	-	-
Guinea	427	-	124	-	258	41	4	-	-	-
Ghana	60	-	-	-	1	-	59	-	-	-
Benin	58	-	-	-	58	-	-	-	-	-
Cameroon	130	-	-	-	130	-	-	-	-	-
Congo	82	-	81	-	1	-	-	-	-	-
Zaire	2	-	-	-	-	2	-	-	-	-
Ivory Coast	513	-	428	-	-	42	43	-	-	-
Sudan	6	-	-	-	-	-	6	-	-	-
Uganda	3	-	-	-	-	-	3	-	-	-
Zambia	14	-	-	-	-	-	14	-	-	-
Mauritius	188	-	-	-	-	-	188	-	-	-
Jamaica	138	-	-	-	-	-	138	-	-	-
Dominica	6	-	-	-	-	-	6	-	-	-
St. Lucia	187	-	-	-	-	-	187	-	-	-
St. Vincent	117	-	-	-	-	-	117	-	-	-
Grenada	13	-	-	-	-	-	13	-	-	-
Others	4	-	-	-	2	-	1	1	-	-
T O T A L	5,599	292	2,534	na	1,413	178	1,161	3	17	na

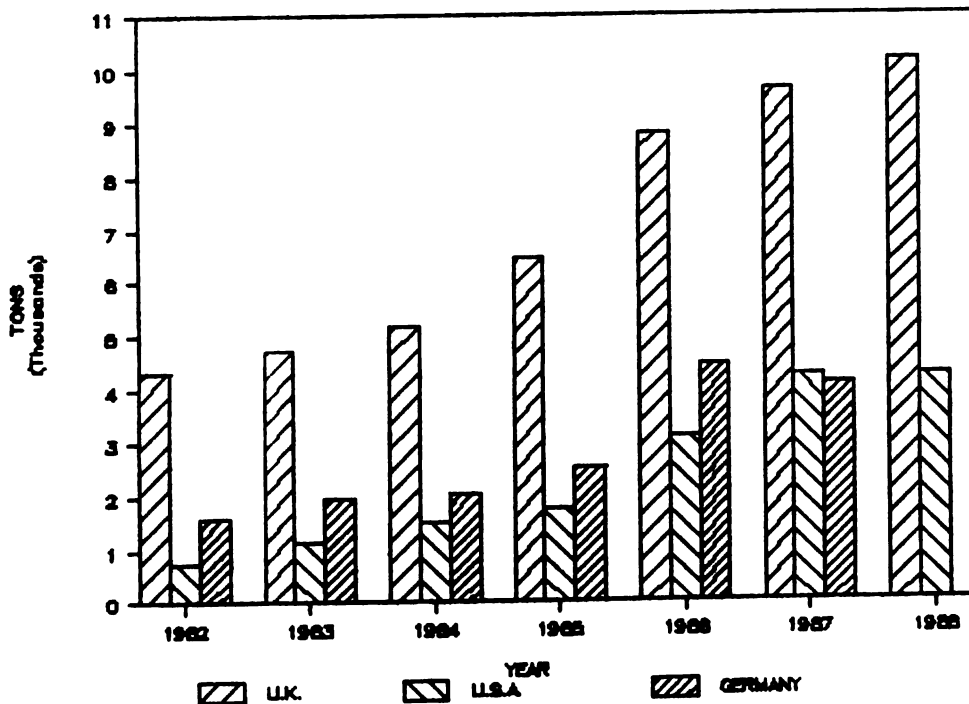
Source: COLEACP

TABLE 5: CALENDAR OF EUROPEAN SUPPLY OF MANGOES

NORTHERN HEMISPHERE	J	F	M	A	M	J	J	A	S	O	N	D
Mali			•	•	•	•						
Burkina-Faso			•	•	•	•						
Ivory Coast			•	•	•	•						
Guinea					•	•	•					
Senegal					•	•	•					
Jamaica				•	•	•	•	•				
Egypt								•	•	•		
Israel						•	•	•	•	•		
India/Pakistan				•	•	•	•	•	•			
Mexico				•	•	•	•	•				
Venezuela				•	•	•	•					
U.S.A.						•	•	•	•			
SOUTHERN HEMISPHERE	J	F	M	A	M	J	J	A	S	O	N	D
Kenya		•			•	•				•	•	
Madagascar										•	•	
Congo												•
South Africa	•	•	•									•
Brazil	•	•								•	•	•
Peru	•	•	•									•

Source: COLEACP

FIGURE 3: IMPORTS OF MANGOES IN SELECTED COUNTRIES



PAPAYA

Specifications:

Varieties: Major varieties: Solo
Minor varieties: Sunrise, Amazon Red

Size: 250 - 500 g.

Shape: Oval

Flesh Colour: Yellow, Orange, Red

Ripeness: M1: Green fruit with a yellow tip
M2: Fruit 1/3 yellow
M3: 1/2 ripe

The trend is now towards the red flesh varieties. Brazil who introduced the Amazon Red may have had some influence on this situation.

The Papaya market is relatively simple. Brazil supplies approximately 80% of the European market. The North American market is supplied from Hawaii. The world papaya market is estimated to be approximately ten (10) years old. The market is expected to grow but not as dramatically as the others. This is due to the highly perishable nature of this item. Air freight is obligatory and expensive.

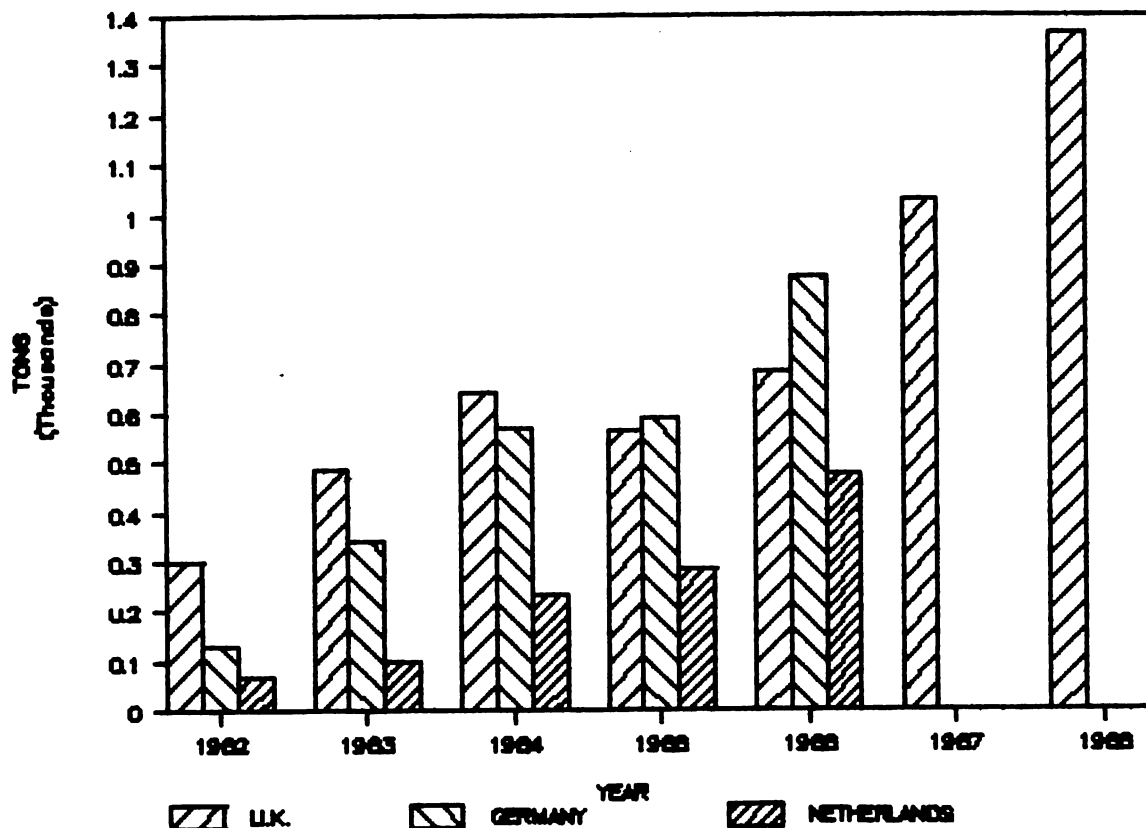
Although both suppliers provide the markets with year round supply, importers are willing to source other supplies because of the vulnerability of this situation. The papaya market is illustrated by Fig. 4.

GENERAL MARKET CONSIDERATIONS

As can be seen from the foregoing, product specification is all important in the international marketplace, this is not accidental. Socio-economic conditions in the markets as well as marketing initiatives have defined the specifications as they exist today. Product specification should be adhered to as they are determinants to success. This is especially true when entering an already developed market as a newcomer. A general rule of thumb is to follow the market leaders.

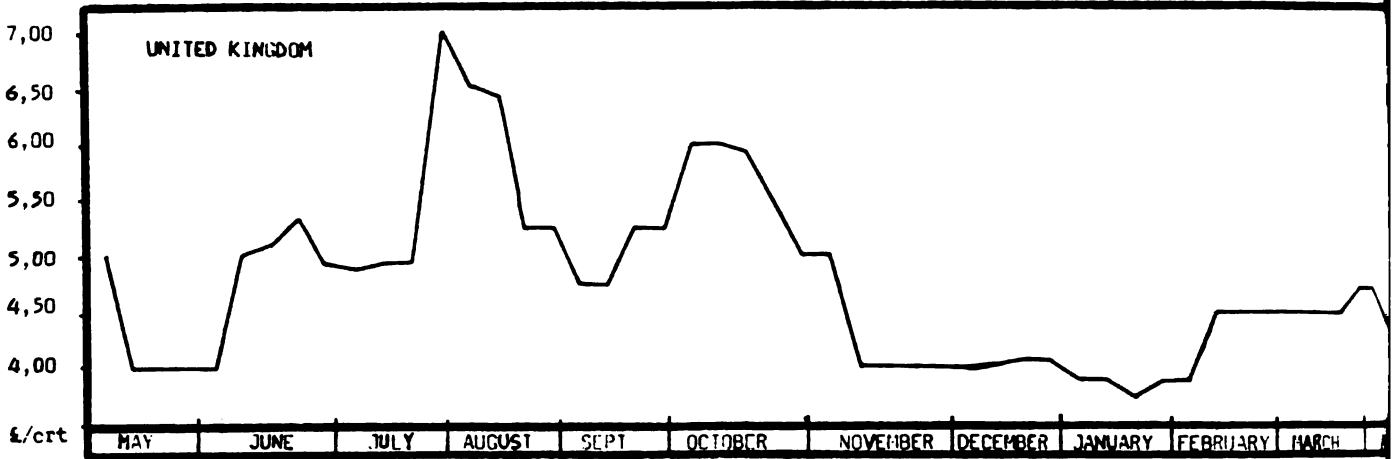
Fresh produce is generally very perishable. There is often a great distance between supplier and market. Produce has to arrive at a final destination in good condition with an appreciable shelf life. It is therefore imperative to ensure only the highest quality produce leave the shores of the exporting country. Importers demand and expect this.

FIGURE 4: IMPORTS OF PAPAYA INTO SELECTED COUNTRIES



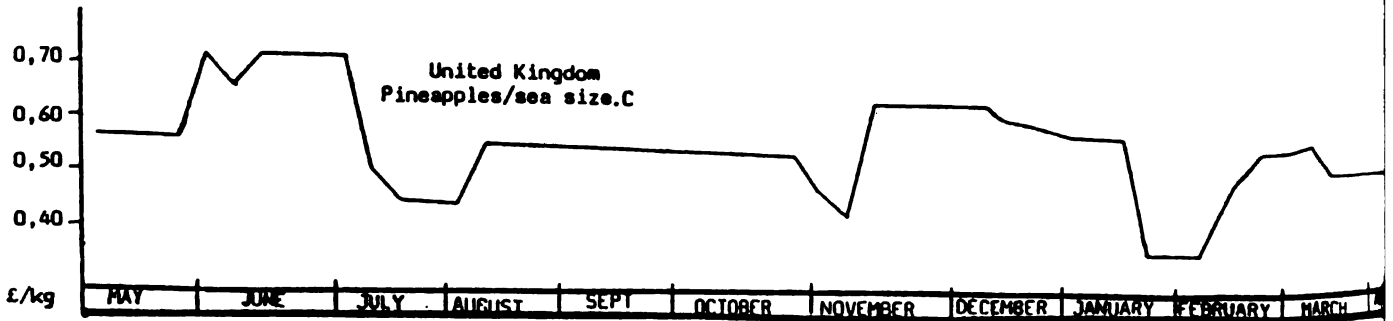
The market for fresh produce is very dynamic. Prices are determined by supply and demand and vary with time. Importers expect competitive pricing. Seasonal price trends are more important than absolute prices (Figs. 5 - 12). Potential exporters should not be seduced by high price expectations. Tropical products enjoy relatively good prices now because of the relative age of the market. This situation is not likely to remain this way for long. Many other developing countries are in similar economic conditions as Trinidad and Tobago and are exploring similar options. This may add up to a situation where prices become depressed because of cut throat competition between suppliers. Exporters should concentrate their efforts into supplying the highest quality produce on time. Performance is therefore the watchword. This can go a long way towards obtaining better prices.

FIGURE 5: AVOCADO PRICES (English Pounds/crt.)



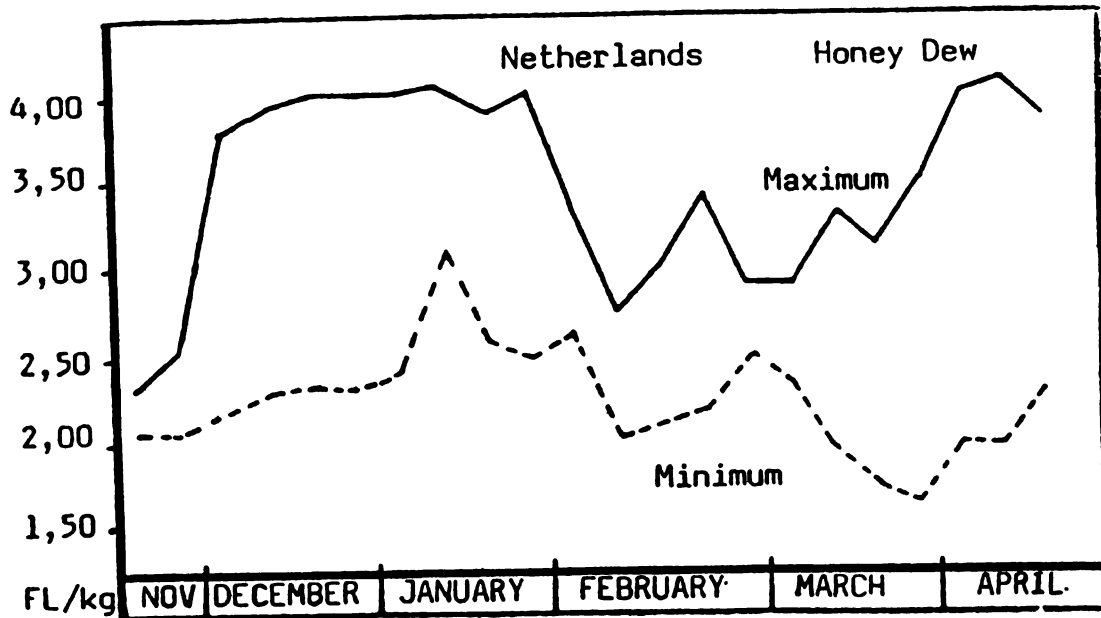
Source: COLEACP

FIGURE 6: PINEAPPLE PRICES (English Pounds/kg.)



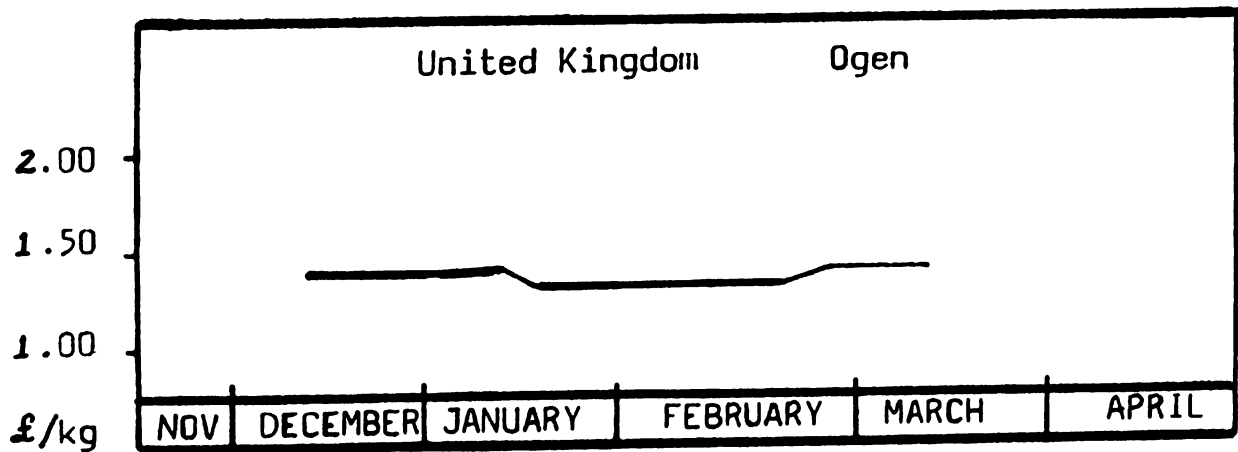
Source: COLEACP

FIGURE 7: MELON PRICES (Netherlands Florin/kg.)



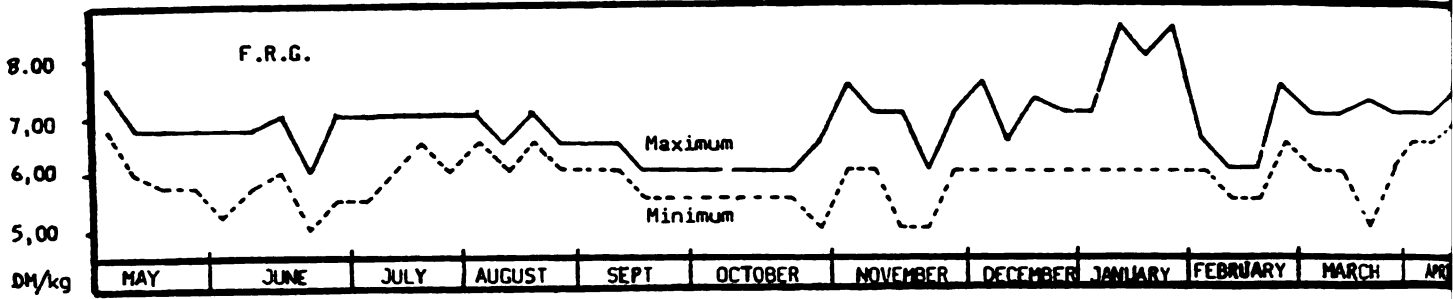
Source: COLEACP

FIGURE 8: MELON PRICES (English Pounds/kg.)



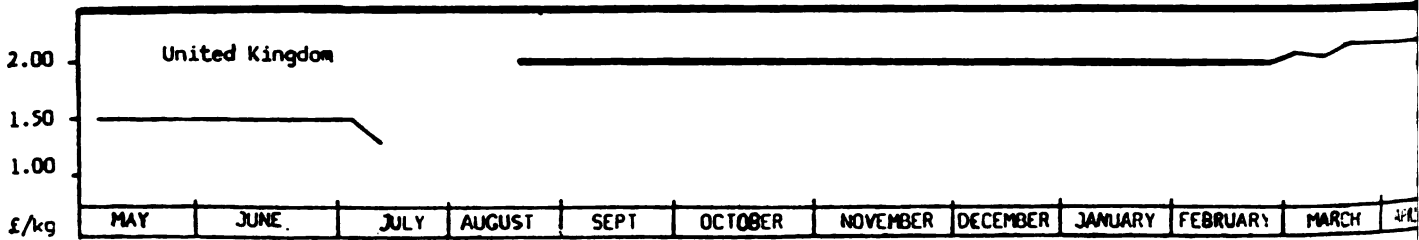
Source: COLEACP

FIGURE 9: PASSION FRUIT PRICES (Netherland Florin/kg.)



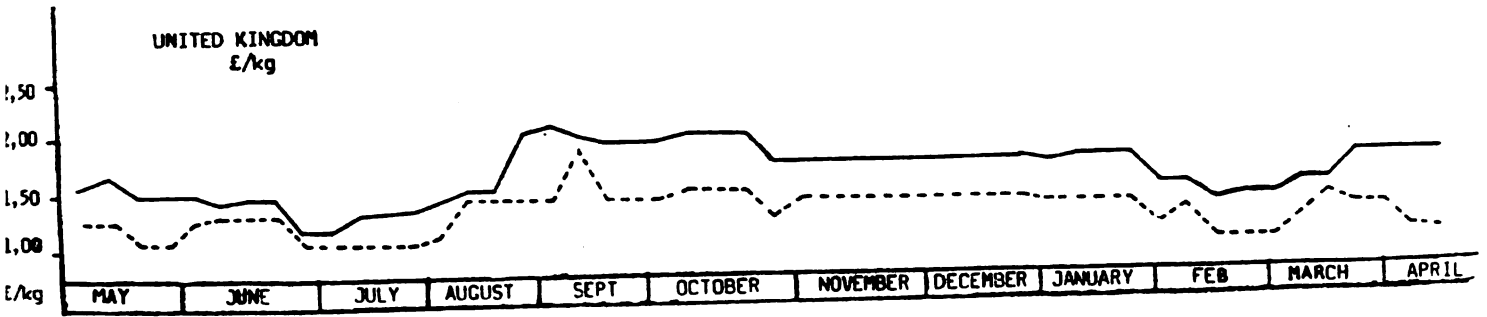
Source: COLEACP

FIGURE 10: PASSION FRUIT PRICES (English pounds/kg.)



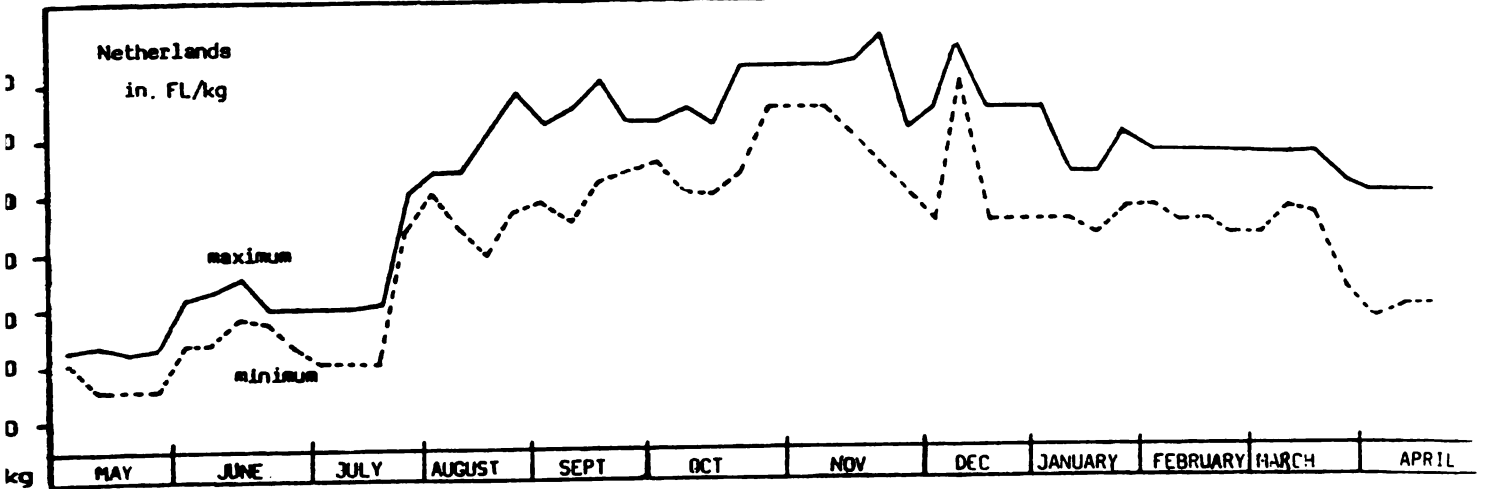
Source: COLEACP

FIGURE 11: MANGO PRICES (English Pounds/kg.)



Source: COLEACP

FIGURE 12: MANGO PRICES (Netherlands Florin/kg.)



Source: COLEACP

EXPORT OPPORTUNITIES

Opportunities do not just happen, they are created. Several examples bear this out. Avocadoes from Israel, New Zealand's kiwifruit, Kenyan passion fruit and Malaysia's carambola and golden banana.

The international market for tropical fresh fruit and vegetables is growing and with some items the rate is dramatic. This feature is characteristic of a young market. Several factors have contributed and will continue to contribute to the healthy growth of this market.

- a. Immigration. A common feature of all the major markets is a significant number of ethnic minorities. These people tend to maintain their cultural links with their mother countries, these links include food. This has fuelled the demand for ethnic products worldwide. With increasing availability of these products, this sector is likely to continue growing.
- b. Travel and Tourism. The increasing tourist and travel trades mean more people are becoming exposed to 'exotic' products as never before. A favourable response to a new product while travelling is likely to carry over on the return home. If the same products are available on the home market, the assumption is that they will be purchased.
- c. Nutrition. The growing awareness of the benefits of healthy eating has had a positive effect on the market for tropical fresh produce. People are now seeking to add variety to their diets by the inclusion of these new and nutritious items.
- d. Improved living standards. With improved living standards including increased spending power, comes the propensity to experiment, try new products. Although purchases of this kind tend to be whimsical, if there is buyer satisfaction, there may be repeat purchases.

TRINIDAD AND TOBAGO ON THE WORLD MARKET

Trinidad and Tobago exports an impressive range of fresh produce:-

Breadfruit	Papaya	Tannia
Breadnut	Hot Pepper	Caraili
Watermelon	Chennette	Ginger
Coconut	Eggplant	Dasheen
Eddoe	Dasheen Bush	Okra
Mango	Plantain	Pumpkin

With a few notable exceptions: mango, papaya, ginger and pumpkin, the demand for these items arises from ethnic markets. Major destinations are the United Kingdom, Canada, the United States of America and the Netherlands in order of importance. The breakdown is as follows:-

**TRINIDAD AND TOBAGO
EXPORTS OF FRESH AGRICULTURAL PRODUCE
TO SOME DEVELOPED COUNTRIES
1987 - 1990**

COUNTRY	VALUE \$TT			
	1987	1988	1989	1990*
U. K.	885,982	992,453	1,538,952	319,293
Canada	420,669	660,322	1,254,443	486,399
U.S.A.	335,827	1,072,650	1,169,741	537,603
Netherlands	420,377	444,975	255.015	1,036

*May 1990

There are indications that some local export items are now finding favour in the general markets e.g. hot peppers and okra. This is expected to result in an increased demand for these items in the near future. While this may be encouraging, we should not expect similar developments for other products, instead, we must be prepared to be more active in the market place.

According to conventional wisdom, the most viable markets for fresh fruit and vegetables are the winter markets. The rationale here is that supplies from the tropics can satisfy the demand when the temperate countries cannot supply their own produce. Unfortunately this rationale has been adopted by most developing countries, a large buyer's market has now developed for many items. The competition is fierce with the most efficient countries emerging victorious. To compete on these markets means we would have to increase our present production level several times over. These markets are for large volumes of selected items. We are clearly out of our league here. Our production and exports are characterized by small scale production and exports of many individual items. In addition, this option often entails the introduction of new and unfamiliar species/varieties and technologies. Often the returns do not justify the investments. A more appropriate strategy is needed, one that takes cognizance of the characteristics of our local export industry, its structure and degree of sophistication.

THE CARICOM MARKET

While the Metropolitan markets are the most obvious choices for most exporters, a Caricom market does exist. This market has going growing steadily with time:-

VALUE TT\$			
1987	1988	1989	1990*
302,792	461,809	681,900	178,566

*May 1990

These dollar values may appear modest but the tonnages they represent are quite in line with the capabilities of many exporters. The message here is simple: know your capabilities and do not go beyond them. Many local exporters are too small to compete on any but the smallest markets. For these people, it would make good sense to explore the possibilities closer to home. The Caricom market is mainly for the fruit and vegetables which are already produced by local farmers. Very few if any modifications are necessary, freight rates are much cheaper than to the metropolis. This is a market that should be exploited.

THE METROPOLITAN/ETHNIC MARKETS

Most metropolitan markets have significant ethnic populations. Trinidad and Tobago has been fortunate to possess a most cosmopolitan population. The various ethnic groups all brought with them their own peculiar dietary components. What this amounts to is that the agricultural produce of this country reflects this heritage e.g. Breadfruit from the Pacific; Silk and Sucrier bananas from the Far East; Yam from Africa and Caraili from India. Trinidad and Tobago produces something for everyone. This is a strength which should be exploited in the metropolitan ethnic markets. Minorities everywhere are increasingly demanding their indigenous foods. All of this translates into potential niches for our indigenous agricultural products.

These niches while essential for establishing footholds must be fully exploited to develop market presence. The ethnic markets are presently served by many small family type operations which possess some measure of vertical integration. These family operations while being individually successful can only scratch the surface of the market potential. The very size of the firms often is the limiting factor. Limited access to capital, sub-standard facilities and physical capabilities severely restrict the development of these small businesses.

We must go beyond this if we are to survive and develop. The

market is very dynamic, significant changes are taking place in terms of volume, quality of produce and the type of businesses which are developing out of this market. It is significant that in recognition of the value of the ethnic market, some major grocery chains in the metropolis have begun stocking ethnic produce. We must not let these opportunities go abegging, we must be prepared to take the initiative, it must be done now. There is a lot of catching up to do.

This country must develop a culture of export agriculture i.e. all the concerned parties: producers, middlemen/exporters and officials must understand and appreciate the demands of exporting. This cannot be overstated. We need to develop market presence especially in the metropolises. This problem must be approached from both here and abroad. In the market place, we need to control our own distribution outlets. Warehousing is essential. This is an expensive proposition maybe not immediately attainable but certainly worth working towards. In lieu of this, a reputable importer/distributor may be accessed to perform this role as they grow, we grow. To further promote the concept of market presence, brand identity is important. We need to be more aggressive in the market.

Very often default occurs at the production end. Unfulfilled contracts are inimical to the trade. Defaults mean loss of confidence in the supplier and loss of market. The existing production systems are too haphazard to sustain an aggressive export thrust. Production systems must be organized to ensure continuous production of high quality produce. Proper handling facilities must be in place to ensure that quality is maintained. Few individual farmers are capable of this type of enterprise. The E.D.C. maintains that only by co-operative efforts can these goals be met. The future of the export industry in Trinidad and Tobago lies with Co-operatives.

TRADE AGREEMENTS

Trinidad and Tobago are signatories to several trade agreements: Lome, C.B.I., Caribbean, Caricom and G.S.P. These agreements allow the country duty free access for agricultural goods on the markets defined therein. We should exploit these concessions fully in the drive to develop the export industry.

CONCLUSION

The international market is filled with opportunities to be exploited. To be successful, we must be committed to that goal. The export market is extremely demanding. There are no easy and quick fortunes to be made. Export is a long term proposition, only through commitment can we hope to succeed.

**TECHNIQUES AVAILABLE AND REQUIREMENTS FOR AIR TRANSPORTATION
OF FRESH HORTICULTURAL COMMODITIES**

by

**James Galera
Sales Representative, CARICARGO**

It is indeed a pleasure to be involved in this workshop, and on behalf of Caricargo, I wish to take this opportunity to congratulate the respective agencies, for organizing a workshop of this nature. Additionally, extending an invitation to the airlines was a strategic decision since and I am sure you will agree, we play a pivotal role in the physical distribution process. In other words, the airline could be aptly described as the "invisible exporter" and in our view a main link in the entire export chain.

Caribbean Air Cargo Company Limited or Caricargo as we are popularly known is an all cargo airline owned jointly by the Governments of Barbados and Trinidad and Tobago. As an airline providing air cargo transportation services, primarily between the USA and the Caribbean, we are totally committed to playing a major role in the further development of our export sector.

Caricargo currently operates DC-8 Jet aircrafts on our Trinidad sectors and the smaller Convair aircrafts performs a supplementary role by servicing the Inter-Caribbean destinations. Our flight schedule varies given market trends and the level of cargo activity. However, we presently operate three flights weekly (Mondays, Wednesdays and Fridays) from Trinidad. I hasten to include that the last quarter lends itself to significant increases in freight tonnage, which frequently results in the airline having to operate additional flights in order to satisfy customer demand.

We wish to draw to the attention of exporters of fresh horticultural commodities that they can avail themselves to the DC-8 aircraft with a carrying capability of 80,000 lbs/36,288 kgs and 7,000 cu.ft. of space. The dimensions of our pallets or containers are as follows:

Length	121"/307 cm
Width	84"/213 cm
Height	82"/208 cm

In addition, the Convair aircraft has the capacity to transport a maximum of 10,000 lbs and there is approximately 1,250 cu.ft. of available space.

Exporters of other perishable and temperature-sensitive products should be aware that a direct flight to Miami for example is of 3¹/₂ hours duration, and the average cabin temperature is

about 60°F given flying altitudes of 31-40,000 ft. In this environment therefore, product quality/freshness is easily maintained. Additionally, commodities requiring lower temperatures (e.g. between - 10°F to 50°F) can be accommodated by renting/leasing temperature controlled containers or envirotainers as these units are commonly known.

We wish to impress upon exporters that packaging is of paramount importance when exporting. Packaging ha to be adequate to allow for efficient handling and to withstand the rigours of air transportation.

Further, it is to be noted that exporters must also ensure that relevant documents are prepared and approval obtained prior to shipping. The documents required when exporting horticultural products are listed hereunder for your guidance.

- Customs Shipping Bills
- Exchange Control Form (FEX-1)
- Caricom Invoices
- Phytosanitary Certificate

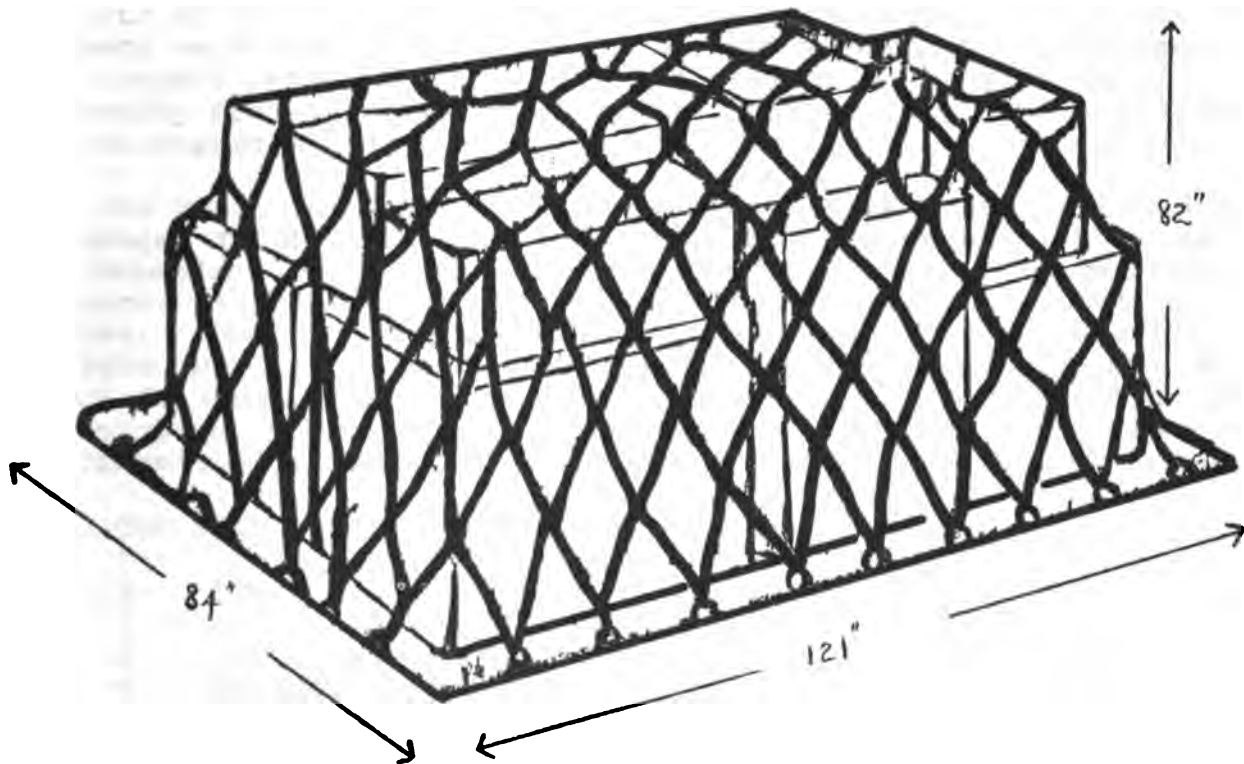
It is interesting to note that Caricargo has frequently assisted and continues to assist exporters in identifying and developing export trade opportunities, especially within the USA and wider Caribbean, which are main target markets. With offices and agents strategically located in some key cities (e.g. Miami, New York, Houston, San Juan-P.R.) our staff regularly interface with key personnel of various trade-oriented organizations and facilitating agencies (e.g. Large Import Brokerage Firms, Wholesalers, Chamber of Commerce, USDA, FDA etc.). In this connection therefore, exporters have derived substantial benefit from our networking.

With respect to the issue of rates, since we operate in a fiercely competitive market environment, we offer "Special Rates" to exporters of specific commodities. However, while the airline is not averse to being flexible, we are of the view that special rates must be matched with a commitment from the exporter to provide sustained poundage and consistency. However, if exporters experience difficulty in meeting targets, they may wish to give serious consideration to the consolidation of exports. This exercise should result in increased freight poundage and the likelihood of obtaining reduced rates. Further, the entire export process could be enhanced by acquiring the services of a reputable agent/distributor at the receiving end who genuinely seeks the interest of local exporters.

In conclusion, I wish to reiterate that Caricargo is totally committed and will continue to make an invaluable contribution to the development of the export sector. Tangible proof of our commitment will be shown in offering exporters/potential exporters

the best values or combination of quality service and competitive rates.

DIAGRAM SHOWING A TYPICAL CARICARGO TYPE 3 PALLET/NET UNIT LOAD DEVICE LOADED WITH FREIGHT



BWIA'S ROLE IN AIR FREIGHT EXPORTS

by

Abraham Galy
Cargo Manager, BWIA

The national carrier has played and continues to play its part in the export thrust. From as far back as 1986, a number of farmers had approached us regarding exports of their produce to New York and Toronto.

In order to assist these exporters we decided on a plan to provide special rates so as to permit effective marketing in the international market place. It was subsequently recognized that exports of produce to Toronto and New York began to increase and farmers were now looking at the London market, to which special air freight rates were provided. At present we now provide special commodity freight rates for almost all our destinations in response to the export thrust.

On must, however, bear in mind that BWIA operates scheduled passenger flights and the acceptance and transportation of cargo is dependent upon the accommodation of passengers and their baggage. The Corporation operates L1011 and MD83 aircraft on its routes. The L1011 or Tristar aircraft carries the majority of freight on its routes as it is containerized unlike the MD83 aircraft which transports bulk cargo. The aircraft holds are pressurized to maintain a temperature between 45-55 degrees fahrenheit in flight.

Our main exports are:

1. Fruits/Vegetables
2. 807 Garment Programme
3. Cut Flowers
4. Frozen/Chilled Seafoods
5. Preserved Foods/Confectionery/Beverages/Beer

The Corporation currently provides cargo space as follows:-

New York	-	69,700 lbs	weekly
Toronto	-	79,500 lbs	" "
London	-	75,000 lbs	" "
Zurich	-	10,000 lbs	" "
Frankfurt	-	10,000 lbs	" "
Stockholm	-	10,000 lbs	" "
<hr/>			
TOTAL	-	254,200 lbs	" "

Most of our exporters require cargo space on choice flights which are not always available. Apart from providing cargo space to our local exporters, the national carrier must also transport cargo to/from the CARICOM region in addition to the movement of air freight from CARICOM to international destinations.

CARGO BOOKINGS

Due to the high demand for cargo space, advance cargo bookings must be arranged through our cargo handling agents, Caribbean Aviation Company, at least 3 days prior to the date of departure. It is very important that in the event booked space is not being utilized that the information be conveyed at least 24 hours prior to departure so that this space could be given to other exporters.

PACKAGING

Cargo must be carefully placed into appropriate boxes or suitable packaging which should provide proper ventilation where required. Each package must carry the full name and address of the shipper and consignee, and cargo must be brought to the airport at least 5 hours prior to departure in keeping with out security procedures.

SHIPPING DOCUMENTS

All documents such as Shipping Bills and FEX forms must be presented at the time the shipment is turned over to our agents for processing. Plant certificates must be obtained from the Plant Quarantine Officer where applicable. Our cargo agents, Caribbean Aviation Company have recently installed cold storage facilities which can be used by exporters in the event this service is required.

In conclusion, I wish to advise that the increase in air freight exports will no doubt in the Corporation operating a freighter aircraft to meet required demands. However, it must be emphasized that this would result in a substantial increase in the current freight rates being provided. Exporters would also be requested to have all freight charges paid by the consignee in foreign currency so as to meet all related costs associated with the freighter operation.

On behalf of the Corporation, I wish to assure all our exporters of our fullest and continued co-operation in the movement of their produce. However, it must be understood that when operating a passenger/cargo service, the availability of cargo space is dependent upon the number of passengers on the flight.

4
**THE ROLE AND IMPORTANCE OF PLANT QUARANTINE FOR
THE SUPPORT OF FRESH HORTICULTURAL COMMODITIES**

by

J
**Assim Dilbar, Agricultural Officer 1, Plant Quarantine
Ministry of Food Production and Marine Exploitation**

INTRODUCTION

In recent years, the volume of foreign travel has increased many fold. So has the volume of trade in plants and plant products and the pests and diseases associated with these crops. The unrestricted entry of plant materials be it for consumption, propagation, etc. has also introduced new pests and diseases which have caused great economic losses to our locally grown crops such as the cabbage looper, thrips and the burrowing nematode. Not only field crop losses are incurred but there is the increased cost through pesticide usage and its applications, developing integrated methods of control, loss of foreign markets as well as the difficulty finding new ones. Government's role is very important in educating its population on the destructiveness of foreign pests and diseases and ways must be adopted to keep them out. This has led to the development of Phytosanitary Regulations in countries around the globe whose responsibility is to placing restrictions on the movement of plants and plant materials to reduce the introduction of new plant pests and diseases.

INTERNATIONAL AGENCIES

Since Plant Quarantine is important to all countries there was the formation of the following bodies to assist in regulating the movement of plant and plant products.

1. The International Plant Protection Convention (IPPC), in 1952 under the umbrella of the Food and Agricultural Organisation of the United Nations whose main objective is to prevent through common and effective action, the spread of pest and disease of plants and plant products and to promote measures for their control in all member countries.
2. The Caribbean Plant Protection Commission (CPPC) established in 1968; in addition to the objectives of the IPPC, this regional body has responsibility for contributing and accessing information related to pest and disease outbreaks and the movement of plant materials both outside and inside the Caribbean area.

3. In 1973, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was established whose objective is self explanatory.

Trinidad and Tobago is signatory to all these organisations and it is the role of the Plant Quarantine Department of the Ministry of Food Production to enforce the above mentioned objectives without disruption to trade both at the regional and international level. This has been achieved through import and export regulations.

IMPORTS

The Import Regulations of 1953 indicate the requirements for importation of plant materials into this country. In summary they are as follows:

1. An Import Permit Application Form must be completed and submitted to the Plant Quarantine Department prior to any arrangements being made for importation of items.
2. If the materials are permitted, the permit indicates the conditions under which the plant materials would be allowed entry. The goods must be free from soil, pests and diseases.
3. Contravention of the Import Regulations can cause delays and embarrassment to the importer whereby the plant materials are subject to the following viz:
 - a. Entry prohibited i.e. not being allowed to land.
 - b. Seizure and destruction.
 - c. Treatment.
 - d. Post-entry detention for further examination by the Plant Pathologists followed by release or destruction on their advice.

Therefore, it is in the interest of the importer to have an import permit before securing plant materials from foreign sources.

EXPORTS

In a like manner, the export of plant and plant products are governed by the Phytosanitary Regulations of the importing country. Before arrangements are made for any exports, it must be determined whether or not the produce or product would be allowed entry into the importing country, eg. no soft fruits are allowed on the U.S.

market. The main reason being the pest and disease status of these crops are not fully known. To alleviate such problems the Ministry is currently conducting a fruitfly survey with assistance from the United States Department of Agriculture (USDA). This may allow the opening up of new markets for our fruits and vegetables.

The Plant Quarantine Department continues to provide the service of phytosanitary export inspection and certification. For certification to be completed, the following conditions must be met.

1. Where an import permit by the importing country has been issued, all the conditions must be satisfied.
2. The material must be free from soil, pests and diseases i.e. it must be clean.
3. If pesticides are used, it should not exceed the maximum residual limits (see later for the impact of pesticide residues on Export).

If the above conditions are not met, a phytosanitary certificate is not issued.

LIMITATIONS

1. Where large volumes are exported, attempts have been made to inspect and certify fresh produce at the pretreatment and packaging site. However, the department has recognized that there has been an increase of over 300% in the volume of exports between 1985 and 1989. The number of phytosanitary certificates issued in 1985 was less than 300 whereas in 1989 the number issued was 1,895. This means that within the near future increased staffing arrangements would have to be made to cater for the growing demands of the service.
2. At present, there are no proper infrastructural facilities in place for the examination of goods at the airport. Inspection is conducted in an open area, therefore, the Plant Quarantine Officer and the goods are exposed to the elements of the weather.
3. It would be to the advantage of the exporter to be at the airport well in advance of the flight departure to have their produce examined thoroughly before the issuing of the phytosanitary certificate.

FUTURE PROJECTIONS

1. The Plant Quarantine Department recognizes that the volume of exports would continue to increase. The issue of staffing has been addressed and it is hoped that as the need arise, this would become a reality especially where examination has to be done at the exporters pre-treatment and packing site.
2. Plans have been submitted to the Airport Authority for the construction of infrastructural facilities at the cargo area. The area ear-marked will be covered, paved and provided with office facilities as well as washing up areas. This will allow vehicles to off-load in a covered, well-ventilated area where the produce can be inspected thoroughly prior to packing in the containers for shipment.
3. It is hoped with the above development, exporters will have proper covered facilities reducing the risk of losses due to the elements of the weather. Also they be at the cargo area well in advance so that the Plant Quarantine Officer can conduct his inspection thoroughly and efficiently.

It is the desire of the Plant Quarantine Department to ensure that all plant material, that is, cut flowers, fruits, vegetables, planting material, etc., are free from pest and diseases and that exporters will comply accordingly. This would not only build a name for the exporter, who has secured markets, but it will definitely build a name for Trinidad and Tobago.

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**PESTICIDE RESIDUES AND ITS IMPACT ON THE
EXPORT OF HORTICULTURAL COMMODITIES**

by

**Audine Mootoo
Biochemist II - Post Harvest Unit
Ministry of Food Production & Marine Exploitation**

Chemical application as a method for controlling pests and diseases has widespread use both during the production of fruits and vegetables and in the post harvest period. In order to protect the health and welfare of man and the environment, it is essential that chemical applications do not leave unacceptable pesticides residues; thus it is necessary to have monitoring programs through which pesticide residue levels can be routinely checked.

This presentation will concentrate on the system of laws in the United States which governs the presence of pesticide residues in food; a system which had direct implications for persons interested in the export of fruits and vegetables to the U.S.

Pesticides must be registered by the Environmental Protection Administration (EPA) for a specific use. This registration is granted based on a showing that the pesticides used will not cause unreasonable adverse risk to man or the environment. EPA is also responsible for the establishment of tolerances which describe the maximum amount of a pesticide residue that may be safely and legally present in a food when introduced into U.S. Commerce.

The Food and Drug Administration (FDA) is responsible for the enforcement of EPA's tolerances. Any food which contains a pesticide residue at a level greater than that specified by a tolerance is considered to be adulterated and is refused entry into US Commerce. If a food contains a pesticide residue for which no tolerance is established, then any amount of residue detected will cause the food to be adulterated.

The operational elements of the FDA's pesticide monitoring and enforcement program consist of a Surveillance Component, food commodities are selected randomly for analysis with no prior evidence that shipments being sampled contain any illegal pesticide residues. The compliance component is initiated when illegal residues are found in the surveillance sample. This represents an intensified and selective sampling of shipments of the suspect commodity for the pesticide residue in question. These shipments are held pending the completion of chemical analyses and if illegal residues are detected, entry into U.S. Commerce is refused.

When a violative sample is detected, the exporting firm is placed on automatic detention and FDA requires that the importer,

shipper, producer or a responsible agency of the exporting country provide certification that future shipments conform with the requirements of the law.

Careless use of pesticides and non-compliance with the legal requirements of the importing country can cause serious disruption of trade and incur high cost to the export industry. Every effort should therefore be made to ensure that pesticide residue levels in food intended for export (as well as for local consumption) are within the limits that comply with the law.

LIST OF ADMISSIBLE FRUITS AND VEGETABLES FROM TRINIDAD AND TOBAGO

- a. The following items are admissible from all countries including Trinidad and Tobago, W.I. into the entire United States (includes Continental United States, Guam, Alaska, Hawaii, Puerto Rico, and the Virgin Islands without a USDA import permit.

Cannonball fruit
*Coconut (without husk or without "milk")
Cyprus corm
Lily bulb, edible
Maguey
Mushroom (fresh)
Peanut (raw)
St. Johnsbread
Tamarind bean pod
Truffle (fresh)
Waterchestnut
Waternut

In addition to the above items, other food materials including such items as dried beans and peas (except Vicia faba, Lens spp. and Lathyrus spp.), dried seeds, dried bamboo leaves, dried herbs, and similar commodities are admissible for food purposes and may be imported without permit from all sources into any port subject to inspection on arrival. Dried nuts without fleshy or leathery husk (except acorns, chestnuts, coconuts and macadamia nuts) are enterable for food purposes without permit at all ports, subject to inspection.

- b. The following items are admissible from Trinidad and Tobago, W.I. with a USDA import permit issued in advance of shipment. Permits are only issued to importers and brokers residing in the United States.
1. Admissible into the entire United States (includes Continental United States, Guam, Alaska, Hawaii, Puerto Rico, and the Virgin Islands):

Allium	Dasheen
Asparagus	Ginger root
Banana (no permit required)	Palm Heart
Basil Leaves	Pineapple (except Hawaii)
Betel Leaves (<u>Piper betel</u>)	Strawberry
Breadfruit	Thyme
Cassava (except Hawaii)	Tomato
Chestnut (treatment required	Watercress
see 319.56-2(b))	Yam (treatment required
Chrysanthemum greens	see 319.56-2(m))
Cinnamomum leaves	
Corn, green	

- c. Admissible into North Atlantic ports - (Atlantic ports north of and including Baltimore; ports on the Great Lakes and the St. Lawrence Seaway; Canadian border ports east of and including North Dakota; Washington, DC (including Dulles) for air shipments):

Bean, pod or shelled	Eryngo
Cacao bean pod	Lettuce
Chinese spinach	Mangosteen
Chinese cabbage	Okra
Cucurbit	Parsley
Culantro	Pigeon pea
Dasheen green	Pepper
Eggplant	Pokeweed greens
	Roselle
	Sorrel

- d. Admissible into South Atlantic Gulf ports - (Atlantic ports south of Baltimore; Gulf ports; Puerto Rico, and the Virgin Islands) and North Pacific ports - Admissible into North Pacific ports - (North Pacific ports do not include California).

Okra (treatment required see 319.56-2(t))
Roselle (treatment required see 319.56-2(t))

- e. Admissible into U.S. Virgin Island:

Yam

Frozen fruits and vegetables: Freezing is an acceptable treatment for most fruits and vegetables. The treatments involves an initial quick-freezing at sub-zero temperatures with subsequent storage and handling at not higher than 20°F at the time of arrival.

CHEMICALS REGISTERED FOR POSTHARVEST USE IN UNITED STATES

CHEMICAL/CROP	ORGANISM	METHOD OF APPLICATION	CONCENTRATION (PPM)	RESIDUE (PPM) TOLERANCE
Benomyl Bananas Citrus Pineapple Stone Fruits	Crown rot, surface mould Colletotrichum	Dip or spray	600	1.0
	Penicillium stem-end rot	Dip or spray	1,200	10.0
	Thielavopsis	Dip or spray	1,200	35.0
	Anthracoese	Dip or spray	300	15.0
Biphenyl Citrus	Penicillium and stem-end rot	2 pads wraps/4-5 wraps (145.6-182 litre)		110.0
Calcium Hypochlorite Fruits and Vegetables Storage bins and Packing plants	Bacteria Mould and yeasts	Wash 2 min. and rinse Brush, spray and rinse surface with potable water	25 available chlorine 700-5,000 available chlorine	
Captan Citrus Pineapples [Cantaloupes] [Cucumbers] [Potatoes] Packing boxes	Storage rot pathogens (Botrytis, Rhizopus)	Dip or spray	1,240	25.0
	Storage rots	Dip or wash	6,000	25.0
	Storage rots	Dip or spray	1,500	25.0
	Reduction of storage rots, mould due to Rhizopus, Botrytis and Collectotrichum	Dip or spray	1,200	
Formaldehyde Equipment Storage Area	Bacteria, Fungi Fungi	Wet Fumigate	0.57 litres/ 67.5 solution (1pt./15gal. solution) 0.57 litres (1pt.) kg plus 0.227 kg. (0.5 lb) potassium permanganate/ 28,300 litres (1,000 ft) for 5 hours. Ventilate	
Sodium Orthophenyl-phenol (SOPP) Citrus Bananas Plums	Penicillium mould and stem-end rot	Spray, wash, dip	0.3-2.0% at 90°-115°F (32°C-46°C) 2.0% paste	10.0
	Crown rot, stem rot	Brush		
	Fungi	Dip, flood or spray, rinse in potable water	0.5 - 1.0%	20.0

CHEMICAL/CROP	ORGANISM	METHOD OF APPLICATION	CONCENTRATION (PPM)	RESIDUE (PPM) TOLERANCE
Pineapples	Thielaviopsis	Spray or dip	4.51/5080.235 kg fruit (1 gal/5 tons fruit)	10.0
Carrots	Fungi	Dip, flood or spray	0.05 - 0.1%	20.0
Cucumbers & Bell Peppers	Bacteria and fungi	Dip, flood or spray and rinse	0.5 - 1.0%	10.0
Sweet Potato	Black rot, soft rot	Dip, flood, spray	0.4 - 1.1%	15.0
Tomatoes	Bacteria and fungi	Tank dip, flood or spray and rinse	0.45% (2-4 mins)	10.0
Thiabendazole Bananas	Crown rot	Dip after de-handling and delatexing	0.4 gal (1.8lt) 5% flowable suspension/100 gal (450 lt) water.	3.0 in peel (0.4 in pulp)
Citrus	Penicillium Stem end rot	Spray, dip or flood	10 gal (45lt) of 5% flowable suspension/90 gal. (405lt) water	2.0
Zinc petroleum Sulfonate Baskets, boxes, crates for harvesting fruits and vegetables	Decay, mould and mildew organisms	Dip, softwood (15 sec.)	1.0 gal (4.5lt) of 15% liquid concentration/ 2 gal (9lt) odourless mineral spirits	none
Ziram Bananas	Crown rot, stem rot	Brush to crown areas paste 0.1% in combination with 2.0% SOPP and 0.1% Sulphur		none

(Source: Ogawa, J.M. and B.T. Manji 1984)

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✓
**CUSTOMS SERVICES AND REQUIREMENTS FOR
SUPPORTING FRESH HORTICULTURAL COMMODITIES FOR EXPORT**

by

✓
**Ralph Newton, Customs & Excise Officer III
Ministry of Finance**

RULES GOVERNING THE LOADING AND EXPORTATION OF GOODS IN GENERAL

The loading of any goods whatsoever in an aircraft or ship for exportation from Trinidad and Tobago is governed primarily by the provisions of the Customs Act, Chapter 78:01 and the Regulations made thereunder. Under the Customs Act, Officers of Customs are given legal powers to administer the laws regarding the exportation of goods from Trinidad and Tobago. Such powers are specifically expressed in some sections of the Act, e.g. the power to refuse shipment if the necessary documents have not been submitted, while in some others they are implied, eg. the authority to take samples of goods prior to granting permission to export. Indeed, the exportation of all goods from Trinidad and Tobago is required to come under the scrutiny of the Customs and Excise Department, not simply as an arbitrarily imposed decree of the State but, rather, primarily because this Department is strategically placed to service the country's economic, social and political interests insofar as the need to exercise control over commodities leaving Trinidad and Tobago is concerned.

The principal provisions of the Customs Act as regards the loading and exportation of goods in general may be summed up as follows:-

- i. Goods may be put on board for exportation or use as ships' stores only :-
 - during official hours (unless specifically allowed otherwise),
 - from an approved place of loading,
 - with the authority of the Officer of customs, and
 - when duly entered, i.e. in pursuance of the acceptance and signature by the Officer of Customs of a shipping bill in the prescribed form duly completed so regards all the particulars to be stated therein and with declaration signed by the exporter.

- ii. An Officer of Customs may open and examine goods put on board any aircraft or ship, or brought to any place in

Trinidad and Tobago to be put on board an aircraft or ship for exportation or use as ship's stores

- iii. Where goods are entered for exportation and such goods, or part thereof, are not duly put on board, the exporter is required to attend before the Officer of Customs within twenty-four hours of the departure of the aircraft or ship and notify him of the short-loading of such goods.
- iv. With regard to ships' stores, prior request to ship must be made on the prescribed Customs form (Application and Permit to take stores on Board, Form C28); the shipment of such is subject to acceptance by the Officer of Customs that the quantities are reasonable and to any terms or conditions Customs may impose.
- v. Under the provisions of the Customs Brokers and Customs Clerks Act, Chapter 70:03, only shipping documents prescribed under the Customs Act duly endorsed by specifically authorised persons may be accepted by Customs for purposes of export, where the transaction is of a commercial nature. The persons so authorised are:
 - a licensed Customs Broker
 - a licensed Customs Clerk - Grade III
 - a licensed Customs Clerk - Grade II
 - a licensed Boarding Clerk in certain instances.

The customs Brokers' Board of Trinidad and Tobago of which the comptroller of Customs and Excise is ex-officio Chairman is the institution legally sanctioned under that Act to issue licences to persons who attain the standards set by the Board. Additionally, it should be pointed out that the Act prescribes specific fees to be paid for the services of a Customs Broker in the preparation of the necessary Customs Forms.

Penalties, quite severe in some cases, may be imposed on exporters failing to comply with the provisions of the Customs Act. For example, Section 154 provides for forfeiture of the goods and a penalty of \$20,000. for unlawfully attempting to ship restricted goods contrary to the terms of the relevant restriction.

II. SPECIFIC RULES GOVERNING THE LOADING AND EXPORTATION OF HORTICULTURAL COMMODITIES

The general rules outlined above apply equally to the loading and exportation of horticultural products. However, the powers of Officers of Customs in their administration of the laws governing the exportation of horticultural commodities extend even beyond the Customs Act to other specific statutes including, more importantly,

the authority to refuse to permit the exportation of fruit under the Exportation of Fruit Act, Chapter 63:53, Section 9, or the power to forfeit any plant or parts of plants exported or attempted to be exported where such is prohibited or restricted under the terms of sections 3 and 4 or the Plant (Export Prohibition) Act, Chapter 63:54.

The Customs Laws prescribe that the specific form of entry for the exportation of locally produced horticultural commodities is the Shipping Bill for Local Produce, form C33. These Forms are printed and sold by the Government Printer, but are also available from a number of local private establishments.

III. CUSTOMS PROCEDURES FOR EXPORTATION OF GOODS IN GENERAL

Normally, the procedures to be followed in the loading and exportation of goods involve the preparation of certain export documents, the submission of same to Customs for acceptance and approval, presentation of the goods and related documents to the Officer of Customs at the export stations, and finally, the actual loading of the goods.

IV. CUSTOMS PROCEDURES FOR EXPORTATION OF HORTICULTURAL COMMODITIES

The procedures for exporting horticultural products do not vary materially from the procedures outlined above for goods in general. Of the few peculiarities that exist in this respect, the most note-worthy are the need in certain instances for export licences to be presented, and the necessity to submit export permits where such are required.

The specific procedures for exportation of horticultural products are as outlined hereunder:-

Step No.1. The Customs Broker or Customs Clerk as the case may be, prepares the Shipping Bill for Local Produce, Form C33 in at least triplicate, ensuring that all the particulars on the form are completed; as well, as prepares an invoice in the approved format and a Form FEX I in triplicate.

Step No. 2. The Shipping Bill for Local Produce, Invoice, Form FEX I, Export Licence (where required) and Agricultural Export Permit are submitted to the Numbering Officer of Customs at either of the following places:

- i. Long, Room, 1st Floor, Customs House, Nicholas Court, Port of Spain
- ii. Customs House, San Fernando
- iii. Customs Office, Piarco Airport
- iv. Customs House, Scarborough, Tobago.

Here the documents are checked, verified and numbered, and on completion of such, the goods are considered 'Entered for Export'. The FEX I form is retained by Customs for onward transmission to the Central Bank.

- Step No. 3. The goods with all the supporting documents, viz. the original Shipping Bill for Local Produce with Export Licence and Agricultural Export Permit attached are presented to the Officer of Customs at the export station. Here the documents are screened and, on the basis of the nature, type, description, quantity and value of the goods, the Officer of Customs decides whether or not the packages should be opened for verification of the contents; if all is found to be in order, the Officer gives authority for the goods to be put on board the exporting aircraft or ship.

V. SHIPMENT OF FRESH AGRICULTURAL PRODUCE - SPECIAL CASES

For shipment of fresh agricultural produce to Canada through the CARIBCAN arrangement, the following documents are required:

- i. Shipping Bill for Local Produce (Customs Form C33)
- ii. G.S.P. (Generalized System of Preferences) Form A
- iii. Caricom Area Invoice.

Similar requirements exist for goods being shipped to the U.S.A. under the Generalized System of Preferences Scheme and the C.B.I. arrangement.

As regards export to Europe under the ACP-Lome Convention, a Movement Certificate in the Form EUR.1 is required to be submitted for endorsement by Customs to enable the goods to qualify for preferential treatment.

In case of the goods being shipped to other Member States of Caricom, a special form of Certificate of Origin and Caricom Area Invoice must accompany the shipping documents being submitted to

Customs.

VI. RELATIONSHIPS BETWEEN CUSTOMS AND OTHER INSTITUTIONS IN THE ADMINISTRATION OF THE EXPORT BUSINESS OF FRESH AGRICULTURAL PRODUCE

a. Relationship with the Central Bank.

Central Bank Form FEX I must be presented to the Officer of Customs with Sections 1 and 2 completed, for his approval of shipment in respect of goods for which payment will be received AFTER they have been exported. In instances in which full or partial payment was received in advance, or in which no payment will be received, the Form FEX I with the relevant sections thereof duly completed and approved before-hand by the Exchange Control Department of the Central Bank should be submitted along with all relevant shipping documents to Customs.

b. Relationship with the Export Development Corporation

In order that Customs will be able to identify products being exported under the CARIBCAN facility, the Export Development Corporation imposes an authorising stamp on the face of the relevant Shipping Bill, the Certificate of Origin and the Invoices, prior to processing by Customs. In similar manner, approval of authorization of export under claim of Caricom treatment is subject to signature on the Certificate of Origin by the Export Development Corporation as the certifying authority and endorsement by the Export Development Corporation of the Shipping Bill and Invoice.

c. Relationship with the Ministry of Industry, Enterprise and Tourism

Where shipment of goods is subject to the grant of an export licence by the Ministry of Industry, Enterprise and Tourism, the Customs authorities can neither process the shipping documents presented nor permit the goods to be exported unless the required export licence is presented before hand.

d. Relationship with Plant Quarantine of the Ministry of Food Production and Marine Exploitation

The Customs and Excise Department has a responsibility to ensure that the provisions of the country's Plant Quarantine Laws (as previously mentioned) are duly observed by exporters. In the exercise of such responsibility, Officers of Customs need to pay careful attention to consignments of fruit, plants and parts of plants being exported, to ensure that no such goods are allowed to be put on board any vessel for export, contrary to any lawful prohibition or restriction. In such matters, Officers of Customs have no discretionary power whatsoever, for theirs is an agency

duty, and only the Plant Quarantine Division of the Ministry of Food Production and Marine Exploitation can waive or vary any stipulated requirements of law.

e. Relationship with the Government Central Statistical Office

A copy of each Customs Shipping Bill passed by Customs is retained for forwarding to the Government Statistician, for the compilation of trade statistics relative to goods exported from Trinidad and Tobago. Officers of Customs are, therefore, required to carefully scrutinise the particulars declared on Shipping Bills presented, to ensure that the statistical information to be extracted is meaningful and correct.

VII. SUGGESTED RECOMMENDATIONS FOR IMPROVING THE LEVEL OF SERVICE OFFERED BY CUSTOMS IN THE ADMINISTRATION OF EXPORTS

The country's current emphasis on export has placed heavy demands on Customs Officials who deal with such matters. Indeed, the volume of shipping documents being processed at present far exceeds what it was, say twenty years ago. Physical arrangements as regards staffing have, therefore, been addressed to the point that additional Officers who are posted to assist in processing shipping bills, as and when the need arises, more so on the approach of weekends when the volume of exports tend to be greatest. But beefing up the support system for exports by merely increasing staff is not in itself the ultimate solution, rather, it only serves to highlight the need for an institutional change from the manual system to the automated. It is anticipated that computerisation of some aspects of Customs work will go a long way towards trade facilitation. Perhaps, therefore, the principal recommendation with regard to improving the level of service from Customs in the area of exports, should be the introduction of computers in document processing.

The number of instances in which goods found on Customs examination of the actual contents of packages for export do not agree with the particulars declared on shipping documents, is on the increase. Indeed, several attempts have been discovered of illicit drugs, in particular marijuana, being brought for shipment incorrectly described, in a manner calculated to deceive the Officer of Customs. Exporters are therefore advised to exercise extreme vigilance and caution when preparing goods for export and to be wary of whom they authorize to process documents on their behalf and to effect shipment, to avoid unnecessary friction with Customs and resulting delays in shipment. It is recommended therefore that avenues for cooperation with the Police Narcotic Squad, the airline, etc. be better set up to facilitate and even in some cases obviate the need for Customs examination of goods for export. Additionally, although there would be a cost factor involved exporters (in particular those making use of containers),

may find it in their best interests to notify customs well in advance of shipment so that Customs examination could be performed prior to the arrival of the goods at the export point. As well, exporters are advised to ensure that their shipping documents are tendered in sufficient time to allow for processing by customs.

VIII. CONCLUDING REMARKS

In striving to better serve the interests of the state and the general public, the Customs and Excise Department offers a twenty-four hour service at Piarco International Airport where, inter alia, the processing of shipping documents and the completion of export formalities can be effected easily. Similar provisions exist on the Port of Spain Wharves and at the country's other principal ports, except for the processing of shipping documents which is usually done during official hours. It should be pointed out, however, that overtime charges may be incurred, particularly in the case of agricultural commodities being shipped as ships stores outside working hours, if the necessary shipping documents are not processed before hand.

It is recommended that exporters of agricultural produce make arrangements well in advance of shipment to obtain phyto-sanitary certificates from the Plant Quarantine Division of the Ministry of Food Production and Marine Exploitation to circumvent delays at Customs at the point of export and to facilitate entry of such goods in the country of importation.

A word of caution is also given to exporters of agricultural produce to avoid declaring false or fictitious values on their shipping documents.

Finally, through the medium of this paper, the Customs and Excise Department would like to place on record the fact that complaints about the level of the service it offers in the export business are almost non-existent. Generally, exporters of agricultural produce should, and indeed do experience few, if any, problems with the Department as the legal requirements for export are relatively easy to observe and the established procedures are, in themselves, fairly simple to follow. It should be noted that customs and Excise Officials can be approached at any time and, indeed, stand ready and willing always to offer advice on any such matters.

REFERENCES

The Customs Act, Chapter 78:01, in particular, Sections 136-162 and Regulations Numbers 104-119.

The Exportation of Fruit Act, Chapter 63:53, Section 9.

The Plant (Export Prohibition) Act, Chapter 63:54, Sections 3 & 4.

The Customs Brokers and Customs Clerks Act, Chapter 78:03 Sections 4, 5, & 16.

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**FINANCING INVESTMENT PROJECTS OF
FRESH HORTICULTURAL COMMODITIES FOR EXPORT**

by

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**Meghnath Gosein, Research Coordinator,
Agricultural Development Bank**

The export of horticultural products requires careful planning of the production process to satisfy the demands of the export market. the production of commodities of the right quality, in the desired quantity and at the required times is essential to any export marketing operation. The attainment of these three factors can be achieved through:

1. Large producers involved in production and export of their commodities.
2. Associations or co-operatives where production takes place on individual small holdings and is done by the association or cooperative
3. The establishment of specialised export enterprises which are not involved in production but purchases produce for export, i.e. packing house operations.

Irrespective of the system chosen there are two distinct activities which will require funding:

1. Production
2. Marketing

Within each of these activities, funding will be required for investment purposes and for working capital. The Agricultural Development Bank fully recognises the importance of the export of horticultural commodities and the important role which financing must play in the success of this export drive. Amongst the objectives of the Bank is the provision of funds to investors in the sector with the aim of considerably enhancing the capacity of the sector to earn foreign exchange. Pursuant to these objectives the Bank has allocated TT\$16. Million in its 1990 loans programme for the funding of horticulture projects inclusive of ornamental horticulture, fresh fruits and vegetables. Of this amount TT\$8.2 Million has been allocated for ornamental horticulture.

Prior to 1985 the Bank's involvement with horticulture, and specifically floriculture, for the export market was negligible. The Agricultural Development Bank firmly believes that there is a lucrative export market for horticulture products with potential for stable growth in the future. among the horticulture product

lines being considered are the tropical fruits, vegetables, orchids, ginger lilies, heliconias and anthuriums.

The Bank has not only geared itself for funding the production of these commodities but is prepared to fund investments aimed at alleviating the problems arising out of the alleged inadequacy of the internal marketing systems. This will facilitate the primary producers and allow producers and marketing agents to benefit from higher prices for better quality produce, economics of scale and volume discounts.

The Bank is therefore willing to provide funding to assist primary producers to market their products or to assist entrepreneurs who may wish to establish specialised marketing enterprises. Co-operatives which choose to pursue production and/or marketing can also benefit from special incentives offered by the Bank.

The availability of high quality planting material is essential to success of a viable export oriented horticulture sector. The establishment of plant propagation enterprises or tissue culture laboratories also presents an investment opportunity for interested entrepreneurs. The funding of such activities also falls under the gambit of the bank and investors can benefit from the preferential interest rates offered by the Bank.

The financing of investment projects on fresh horticultural commodities for export is part of an attractive package offered by the Bank. Funding is also provided for working capital. The nature of the production system is such that extensive periods exist between the incurring of cost and the accrual of returns. This period is further extended when one engages in export. The Bank provides working capital funding to bridge this gap between expenditure and income. In the very near future the Bank will be providing a revolving loan facility which will further accommodate entrepreneurs needing funding of this nature.

The provision of funds is complemented by technical and marketing assistance offered by the Bank. The Bank works closely with its clientele to ensure that the farm management practices employed including planning, record keeping, crop protection, etc. allows the entrepreneurs to obtain maximum returns from his investment. This is done through a well developed system of information, advice and training. Where possible the Agricultural Development Bank provides available marketing information to assist the client in exporting his produce.

The horticulture sector, and more specifically floriculture, is heavily dependent on imported components. Where essential inputs are not locally available, the Bank can assist borrowers in obtaining the necessary foreign exchange approvals to facilitate imports.

Lending is geared for small, medium and large scale producers and there are no lower limits or ceilings on loan sizes. The loans for horticulture are of three types in terms of length of repayment period:

1. Short-Term Loans, up to 18 months.
2. Medium-Term Loans, up to 10 years.
3. Long-Term Loans, up to 12 years.

The present interest rate is 12% per annum on a reducing balance. The effective rate which the borrower pays is therefore approximately 7% per annum.

The Bank views agricultural co-operatives as sleeping giants which can be the life-blood of the horticulture sector. In its effort to encourage the establishment and functioning of such co-operatives, either as producer entities or marketing co-operatives, the Bank offers a special incentive of funding at a rate of 2% below its normal lending rate. This results in an effective rate of less than 7% per annum.

In its loan appraisal process the ADB examines five major areas:

1. Borrower characteristics
2. Technical feasibility
3. Financial viability
4. Markets and Marketing
5. Security

1. Borrower Characteristics

There is a statutory requirement that individual borrowers must be citizens of Trinidad and Tobago by birth or naturalization and must be 18 years and over. In the case of companies, they must be incorporated in Trinidad and Tobago.

Individual applicants are required to furnish either their identification card, passport or birth certificate while corporate applicants should furnish their certificate of incorporation.

The applicant's experience and knowledge of the proposed enterprise inclusive of production and export are essential ingredients in the project. He/she must have the necessary

managerial skill to ensure successful implementation and operation of the project. Where the applicant does not possess the necessary managerial skills, it will be required that such managerial skills be put in place.

An assessment of the borrower's credit experience with the ADB and other financial institutions is undertaken to determine his/her credit rating. Where a corporate entity is engaged in the project the credit rating of the directors will be examined.

2. Technical Feasibility

A technical appraisal is conducted to determine the feasibility of the project. All inputs (land, labour, capital, planting material, etc.) must be available in the right quantity and quality. The project must allow these inputs to be combined to efficiently produce the outputs.

3. Financial Viability

It is necessary but not sufficient that the inputs can be efficiently combined. This must be done in a manner which results in financial viability. The Bank does not only seek to have its loan repaid, it is equally important that the borrower earns sufficient income to satisfy his objectives.

4. Markets & Marketing

The product is of no value if it cannot be sold. Proper management and planning would dictate that the entrepreneur first seeks his markets and then produces. It is therefore necessary to determine whether there is an existing or potential market for the product. The size of the market, product specifications, packaging, etc. should be known before one embarks on production. Having identified the existing or potential market and being able to successfully produce a horticultural commodity is not a guarantee for success. The process of moving the commodity from the point of production to the consumer is as important as producing that commodity. The costs involved and the inputs necessary can be greater than those involved in the production process. The Bank needs to be satisfied that adequate arrangements for marketing of the commodities exist or will be put in place.

5. Security

When discussing loans with any financial institution security often becomes a contentious factor. There is no fixed formula to determine the extent of security required. The security requirement, while being very important, is not the major criterion in the loan appraisal process.

The extent of security required is determined by the risk involved in the project. the risk factor is a function of the borrower characteristics, technical feasibility, financial viability and marketing. The form which the security takes varies with the type of investment and can range from personal guarantees to mortgages.

APPLICANT'S CONTRIBUTION

The Bank requires the applicant to make a contribution towards the investment. This contribution indicates to some extent the level of seriousness and commitment of the investor. The applicant is required to contribute a minimum of 20% of the project cost.

REPAYMENT

The loan is repayable on a amortization plan by means of a number of fixed monthly, quarterly or semi-annual instalments sufficient to cover the interest on the loan. such an amount is applied towards the principal as will repay the debt within the agreed period.

It is recognised that the nature of horticulture projects involves a gestation period between investment, production and revenue generation. Cognisant of this, the bank seeks to facilitate investors through the provision of the moratoria on principal payments. The length of the moratorium will vary with the type of the project but borrowers can be assured that repayment is geared to coincide with revenue generation.

Investments in horticulture for the export market can provide attractive returns to enterprising entrepreneurs. The Agricultural Development Bank is committed to working with investors to ensure that maximum benefits are obtained from that vast export market. The provision of a package of financial, managerial, technical and marketing assistance to horticulture producers and exporters is a demonstration of this commitment. It is now left to our entrepreneurs to grasp these opportunities which will benefit not only themselves but our country as a whole.



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**TRINIDAD AND TOBAGO BUREAU OF STANDARDS
WHO ARE WE?
WHAT CAN WE DO FOR YOU?**

by
/

**Loyce Constant,
Trinidad and Tobago Bureau of Standards**

The Trinidad and Tobago Bureau of Standards is a Statutory body though not under the control of the Statutory Authorities commission. It was established by an Act of Parliament (Act 38 of 1972) but was not formally opened until July 8, 1974.

The major functions of the Bureau are summarized as follows:

- to produce and implement national standards
- to disseminate information on standards and specifications
- to educate the nation on standards
- to advise manufacturers and producers on quality control and the preparation of standards; and
- to inspect any operation in connection with any goods for which a compulsory standard has been declared.

The Bureau can recommend that a standard be declared compulsory under the following conditions which apply to horticultural exports.

- a. to insure quality in goods used for export
- b. to prevent fraud or deception arising from misleading advertising and labelling; and
- c. to require adequate information to be given to the consumer.

The Bureau is one of two national standards bodies, the other is the Chemistry Food and Drugs Division which deals with food, drugs, cosmetics and medical devices. The Bureau however, is **responsible for the co-ordination of all standards work by other institutions.** As a member of the International Organization for Standards (ISO), the Pan American Standards Commission (COPANT) and the CARICOM Standards Council, the Bureau is able to source material from and contribute to the deliberations of these international and regional standards bodies. The bureau is also the CARICOM Standards Council Representative on Codex Alimentarius.

The national representative is Chemistry Foods and Drugs Division.

The Bureau is responsible for the preparation of standards for all products and practices, services and processes except foods, drugs, cosmetics and medical devices. The standards produced have input from all levels of the society from the producers/manufacturers, consumers to government bodies and technologists. Organizations whose terms of reference include the implementation of standards, can invite the Bureau to prepare relevant standards, for example, the Central Marketing Agency solicited the services of the Bureau in the preparation of the Standard-TTS 21 10 504: 1979 Requirements for the Grading and Labelling of Table Eggs.

Other standards of interest to the Horticultural Community are those referring to fertilizers and pesticides, for example TTS 6 15 501: 1979. Specification for Urea - Fertilizer grade, and TTS 6 20 401: 1980 The classification of Pesticides and Certain Toxic Chemicals, the latter being a compulsory standard.

In addition to the preparation of standards, the Bureau implements its compulsory standards and provides facilities for testing and certification of goods and processes. By making use of its information services, the Bureau is able to source the standards requirements of all major importing countries and provide Batch Certification for the exporter.

C L O S I N G S E S S I O N



CLOSING REMARKS

by

**MR. ALBERT VINCENT, CHAIRMAN,
CENTRAL MARKETING AGENCY**

As we now proceed to bring to a close this workshop on Post Harvest Handling of Horticultural Commodities for Export, it is important that we do not lose sight of its significance within the context of the transformation process which has been taking place within the Central Marketing Agency over the past three years. Since 1987, the present Board and Management of the Agency in accordance with Government policy mandates, have been seeking to move the organization from one which though burdensome on the Treasury contributed little to the country's agricultural development to one which is structured to provide essential marketing services to the food and agriculture sector and at the same time require less supportive financial resources from the State.

The Board embraced the position that the Agency should withdraw from trading activities and assume more responsibility for regulatory and service functions. This position was supported by the general observation that trading in agricultural produce better lends itself to conduct by private sector enterprises where there is greater organizational inclination towards creating the kinds of flexible operating procedures and systems critical to efficient produce handling.

The new role envisaged for the Agency therefore was one where it would serve to facilitate progressive trading activity rather than engage in trading activity itself. In a facilitating role the Agency was seen as providing important marketing services specifically geared to the promotion of efficient marketing systems for agricultural products. Important among the services to be provided were:

- i. the provision of market information and the conduct of market research
- ii. the design of production and marketing programmes for strategic commodities targeted by policy for either import substitution or export development
- iii. the identification, development and promotion of Agroindustrial projects
- iv. the development and monitoring of a national system of grades and standards and the provision of advisory services in the area of post harvest technology.

v. the provision and administration of wholesale markets in strategic localities.

The essential administrative and in some ways painful task of the Agency's Board and management over the past three years was therefore to simultaneously phase out the old procedures and systems bound up with trading activities and introduce incrementally the new functions and services. During this period the structural foundations were also being laid for the evolution of the Agency into the National Agricultural Marketing and Development Corporation (NAMDEVCO) which entity would be charged with the responsibility for the full implementation of the new marketing functions earlier identified.

The change process embarked upon at the Agency was valuably assisted by a technical cooperation input from the Inter-American Institute for Cooperation on Agriculture (IICA). The new areas of activity within the Agency which benefitted considerably from the arrangement with IICA have been the development of the market information system and the development of an Agroindustrial project development unit. It was also agreed that IICA would assist the Agency in the organization of this Seminar on Horticultural Commodities for Export. Indeed the Board was very pleased to see our Ministry and the University joining with IICA and the Agency to make this seminar possible. No doubt the quality of the seminar would have reflected the rich composition of organizational and technical skills harnessed through this wider collaborative effort. The agency therefore places on record its appreciation to IICA, UWI and the Ministry of Food Production and Marine Exploitation for joining with us in hosting this very important seminar which is a symbolic sense serves to usher in the Agency's initial efforts to pursue one of its new functions as a facilitator in the provision of advisory services in the area of post harvest technology.

As we reflect briefly on the thrust of the workshop itself and its major findings and recommendations as summarized by Dr. Sealy, we must understand clearly that exploiting the growing export markets for horticultural commodities requires a systematic, coordinated and integrated approach involving both the State and the private sector. True, the external markets for horticultural commodities are abundant and growing, but we are not the only ones targeting these markets. Those countries which are succeeding in penetrating these markets are not doing so without organized concerted and administered efforts which have lead to their establishment of efficient integrated systems of growing post harvest handling, shipping and the selection and control of distribution channels in destination markets.

Let us hope that this workshop would have made an important contribution to sensitizing all participants, whether they be growers, traders, technicians or planners, to the challenges and opportunities for this country to resolutely organize itself to

develop and sustain a capacity for the supply of quality horticultural commodities to external markets. I feel confident that the workshop has succeeded in arousing a communal sense of awareness of possibilities and also in mobilizing a renewed and unified commitment to problem solving by all vested interests involved in the export of horticultural commodities. Let us build on this euphoric foundation and challenge ourselves to succeed in this potentially exciting and dynamic area of our national economy.

CLOSING ADDRESS

by

**THE HONOURABLE DR. SURUJRATTAN RAMBACHAN,
MINISTER IN THE MINISTRY OF INDUSTRY, ENTERPRISE AND TOURISM**

Mr. Chairman, ladies and gentlemen. I am happy to attend this closing ceremony of the Workshop on Post Harvest Handling of Horticultural Commodities for Export, in place of the Honourable Minister of Industry, Enterprise and Tourism, Dr. Bhoendradatt Tewarie, who is currently out of the country. I must categorically state that the Ministry is very eager to formulate a programme of action to foster the development of the Horticulture Industry in Trinidad and Tobago. The Ministry has recently initiated discussions with several of the Government agencies which impinge on the Horticulture Industry as well as with some of the major entrepreneurs in the industry.

Notwithstanding the relatively high rate of growth in the export of horticultural commodities experienced within recent years, the floriculture sub-sector is still in its fledgling stages when one considers the tremendous capability that exists in the industry, the export potential and a growing world market for these product. Total world imports of cut flowers, cut foliage and plants amounted to US\$2,488 million in 1985, up from US\$2,168 million in 1981, an increase of nearly 15% during the five-year period. Developing countries supplied a rising share in total imports up from 13.7% in 1981 to 15.4% in 1985. There is a rising trend in both demand and supply in the world's horticultural trade.

The leading importers of cut flowers in the world are the North American and European countries. The Federal Republic of Germany is by far the largest importer of all categories of horticultural products amounting to some US\$766.0 million in 1985. The United States is the second largest import market and the most dynamic, followed by France, the United Kingdom, Switzerland and the Netherlands. Canada is the ninth (9th) biggest importing country in the world. In terms of exports, the Netherlands dominates the world export trade in horticultural products with a market share of 65% in 1985 amounting to US\$744 million. Colombia is the world's second largest supplier followed by Israel and Italy. Developing countries have also been increasing their share in the export market. Here in the Caribbean, Jamaica has already put in place infrastructural facilities with incentives to develop anthuriums both for the United States and European markets. Within recent times, the Jamaican reputation for a superior product has been well established.

Trinidad and Tobago is well poised along the foothills of the Northern Range and those of the Central Range with adequate climatic conditions to develop anthurium production along with

other plants such as orchids, ginger lilies and heliconias. Already there are many small cultivations of these plants and an awareness and interest displayed by small and medium-sized entrepreneurs to exploit commercially, export-oriented development. Trinidad and Tobago has already been established on the world floricultural map by actually winning gold and silver medals at the largest and most prestigious annual international Chelsea flower Show in London for two (2) consecutive years. It clearly demonstrates the potential that exists in Trinidad and Tobago for quality production of horticultural products.

Mr. Chairman, notwithstanding the market access facilities provided under preferential arrangements under the CBI, CARIBCAN and the Lome Convention for horticultural products and production capability which exists for such products in Trinidad and Tobago and other countries for that matter, the problem of importers' requirements remain critical to export success. Importers requirements are generally based on good quality and grading as well as in packaging and labelling. Due to the very perishable nature of these products, post harvest handling of horticultural commodities for export would really determine success or failure for any venture in this sub-sector. I am sure that this workshop has demonstrated the importance of this aspect of the industry and that you have discussed how flowers should be treated at the harvest, post harvest and transport stage to ensure that they reach the buyer in foreign markets in the shape they had when harvested. You must have learnt the techniques of grading, preservation, packing, pre-cooling, storage, shipping, transport from cold storage to airplane and other elements which would ensure speedy dispatch of the flowers to overseas destinations.

Mr. Chairman, what is needed of this sub-sector in Trinidad is comprised of a relatively small number of small to medium-size producers and hundreds of small producers who cater for the domestic market. There is also a cadre of skilled horticulturists who possess the know-how due to their long experience in growing tropical plants. The fact remains that growing for the domestic market is entirely different from that which is required for the export market. Real expertise in exporting is a pre-requisite to a successful industry. I really hope that this workshop has laid the foundation for the post harvest handling of horticultural commodities for the export market and that you as entrepreneurs will now take advantage in mastering the new techniques which are required for exports.

In terms of the general and specific objectives of your Workshop it would seem that in the summary and recommendations which ensued, the major objectives have in fact been achieved:

You have been introduced to the commodity systems approach in analyzing market opportunities which seeks to ensure a more holistic approach to the question of determining what marketing

opportunities should be pursued. This approach is no doubt an excellent methodology for technical persons involved in problem solving within the agricultural marketing system.

You reviewed the major factors responsible for ensuring quality in the cut flower destined for export as well as fresh fruit, vegetables and root crops. Pineapple as you have learnt has been successfully exported out of Martinique.

Due to the inadequacy of many pre-harvest cultural practices post harvest diseases develop and affect the quality of our export products. You have examined major diseases involved and I trust that the technological solutions offered will be applied in your attempts to improve your product.

The question of packaging, transport, quarantine and customs services are critical support factors that often determine the success at export market penetration. These have been thoroughly examined and I am positive that the participants are now better equipped to deal with these areas.

Last, but not least is the question of insurance and financing. Insuring perishable commodities is a high risk business but as volumes grow and exporters increase their reliability the risk involved will be reduced and there would be an increased likelihood of services being offered in this area.

All in all there is obvious need for increased collaboration between all Ministries involved in the export thrust and we look forward to increased inter-agency cooperation in the future. The possibility of identifying a focal point for the dissemination of information to the public is currently being considered among the agencies involved in horticulture development.

Consistent with Government's major objective of the Agricultural Sector in the decade of the 90's in terms of increasing exports of non-traditional crops to the international market place, it is opportune for Trinidad and Tobago to take advantage of the increasing demand for tropical exotic products in the specialised emerging 'International Horticultural Commodity Market'. If Trinidad and Tobago is to become competitive in this international market the question of standards must become of paramount concern to the farming community.

Finally, the Government in its thrust to develop an export-oriented economy is presently engaged in a number of initiatives that would result in increased possibilities for exporters as well as increased support services for the horticulture industry.

A P P E N D I C E S

APPENDIX 1

PROGRAMME

Monday 25th June, 1990

- 08.00 REGISTRATION: (Undercroft) Faculty of Engineering, UWI,
St. Augustine
- 08.30 **OPENING CEREMONY**
- 09.30 COFFEE BREAK
- 10.00 Commodity Systems Approach in Analyzing Market
Opportunities.
Mr. Jerry La Gra, IICA Office in St. Lucia
- 11.00 Post Harvest Handling Systems for Tropical Cut Flowers,
Foliage and Potted Plants.
Mr. Luc Nema, Horticultural Society of Martinique
- 12.00 LUNCH
- 13.00 Post Harvest Handling Systems For Fresh Fruit, Vegetables
and Root Crops.
Dr. Lynda Wickham, Dr. Clement Sankat and
Mr. Majeed Mohammed, UWI
- 15.00 COFFEE BREAK
- 15.15 Post Harvest Pathology of Fresh Horticultural Products.
Dr. Fritz Elango, UWI
- 16.00 **SUMMARY AND DISCUSSION**

Tuesday 26th June, 1990

- 08.00 Packaging and Labelling Requirements for Exporting
Fresh Cut Flowers, Fruits and Vegetables.
Dr. Edmund Brandt, ESEEDA - Eastern Caribbean States
Export Development Agency
- 10.00 COFFEE BREAK
- 10.15 Production, Post Harvest Handling and Marketing of
Fresh Pineapple for Exports: A successful case.
Dr. Alain Pinon, Centre de Coopération Internationale en
Recherche Agronomique pour le Developpement, Martinique

- 12.00 LUNCH
- 13.00 International Marketing Opportunities for Fresh Fruits, Vegetables and Cut Flowers.
Mr. Michael Joseph, Trinidad and Tobago Export Development Corporation
- 14.00 COFFEE BREAK
- 14.15 Organizing Farmers For Export in the OECS Countries: A Successful Case.
Mr. Jerry La Gra, IICA
- 15.15 New Developments in Packaging Material for Use in Exporting Fresh Horticultural Products.
Mr. Benedict Chatoor, CARIRI
- 15.45 **SUMMARY AND DISCUSSION**

Wednesday 27th June, 1990

- 08.00 Techniques Available and Requirements for Sea and Air Transportation of Fresh Horticultural Commodities.
Mr. Larry Hospedales, General Aviation Services Ltd
Mr. James Galera, CARICARGO
Mr. Abraham Galy, BWIA
- 09.00 Role and Importance of the Quarantine Department for Supporting Exports of Fresh Horticultural Commodities.
Mr. Assim Dilbar and Mrs. Audine Mootoo, Ministry of Food Production and Marine Exploitation
- 09.30 Customs Services and Requirements for Supporting Fresh Horticultural Commodities for Export.
Mr. Ralph Newton, Customs and Excise Division
- 10.00 COFFEE BREAK
- 10.15 Financing Investment Projects of Fresh Horticultural Commodities for Export.
Mr. Meghnath Gosein, Agricultural Development Bank
- 10.45 Services, Insurance and Financing Export Activities and Projects.
Mr. Lennox Osbourne, Trinidad and Tobago Export Credit Insurance Company
- 11.15 **SUMMARY AND RECOMMENDATIONS**
- 11.50 **CLOSING REMARKS**

APPENDIX 2

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AGROBUSINESS... where the Profit is.



Because we at Republic Bank believe in Agriculture as a profitable business, we have employed a full-time Agricultural Advisor, to assist you with your technical and financial needs.

Anticipating the direction of future growth we encourage the introduction of new machinery and technology - such as - Automated Production . . . Greenhouse Cultivation and Animal Feeding.

At Republic Bank, we are committed to Agriculture as a growing business, and invest more money in Agrobusiness projects than any other commercial bank.

We can provide loans on a short or medium term basis, at favourable interest rates for food production projects with special repayment arrangements.

Republic Bank responds quickly to loan requests to enable customers to profit from favourable weather and market conditions.

So, if you have the drive and marketing ability, come in to any of our conveniently located branches and speak to the manager. We assure you - there's profit for you in Agrobusiness.



REPUBLIC BANK

FINANCE IN THE AGRICULTURAL SECTOR

The Role of Republic Bank

Republic Bank Limited has for a long time been associated with the agricultural sector in Trinidad and Tobago. As a matter of fact, the arrival of Colonial Bank in Trinidad had to do with the sugar industry and its adjustment to change brought about by the Emancipation of the Slaves.

The Agricultural Sector has been drastically altered since that time, with a larger and more progressive vegetable producing sub-sector; a vibrant livestock sub-sector; and diversification in other areas such as tree crop cultivation, cereal production and other such staples.

Republic Bank's support for agriculture also changed with the emphasis less on trade financing as in the early days and more on production financing and advisory services.

Since the mid-1970's Republic Bank, then Barclay's Bank of Trinidad and Tobago, has engaged the services of an Agricultural Advisor in order to enhance its services to the Agricultural Sector. His expertise is available to complement the Republic Bank Branch office. He can give farm management advice in his own regard or he can direct technical enquiries from the farming community to the relevant Governmental authorities. His role is supportive of the Credit function which remains with the Branch office.

The applicant must be able to satisfy the Branch office that:

- * the project is technically and financially viable, i.e. that it can meet the expenses incurred, repay the bank, and give a reasonable return to the farmer's investment;
- * he possesses the appropriate experience, management and skills to run the project;
- * he is credit worthy in that he has been able to comfortably meet his commitments in the past;
- * he enjoys security of tenure - he is in possession of freehold or long term leasehold title to the land. In the case of leasehold title, he must ensure that the terms of the lease enables him to borrow from commercial banks.

Short term facilities to meet working capital requirements, medium term facilities to meet vehicle and machinery needs, are available from Branch offices. Longer term facilities can be negotiated with Republic Finance and Merchant Bank Limited (FINCOR). Repayments on loans can be programmed to coincide with

Which Bank...



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**agricultural
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Financing to feed the nation is our business



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