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**IICA**



# FACILITATION OF CARIBBEAN INTRA REGIONAL TRADE IN FRESH PRODUCE

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INTER-AMERICAN INSTITUTE FOR COOPERATION ON AGRICULTURE  
TECHNICAL COOPERATION AGENCY IN BARBADOS  
AREA OF CONCENTRATION III: AGRICULTURAL HEALTH

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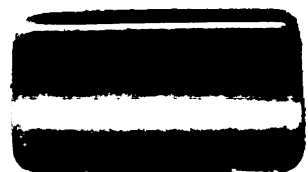
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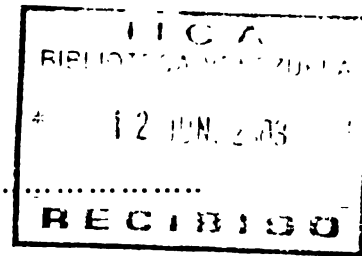
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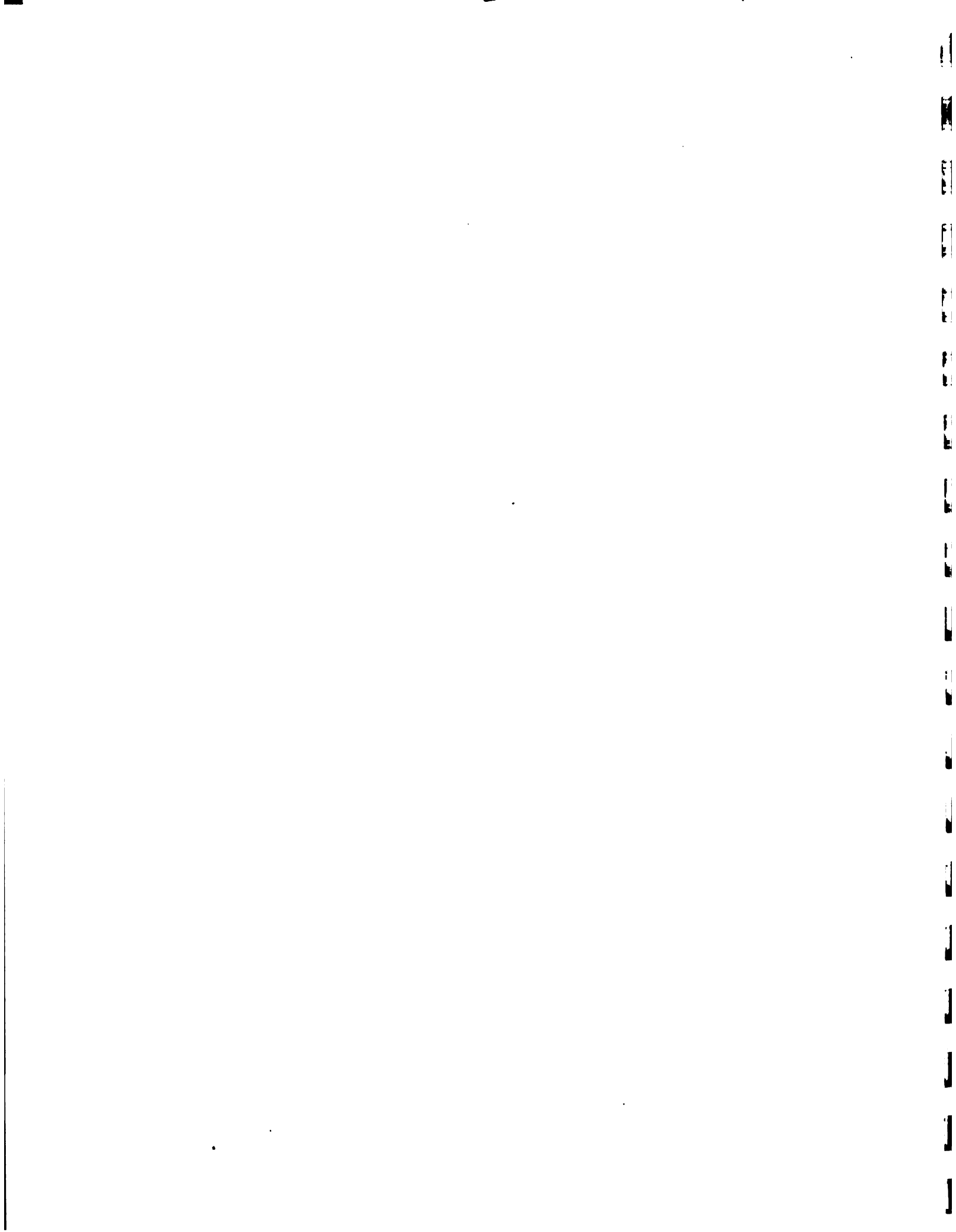


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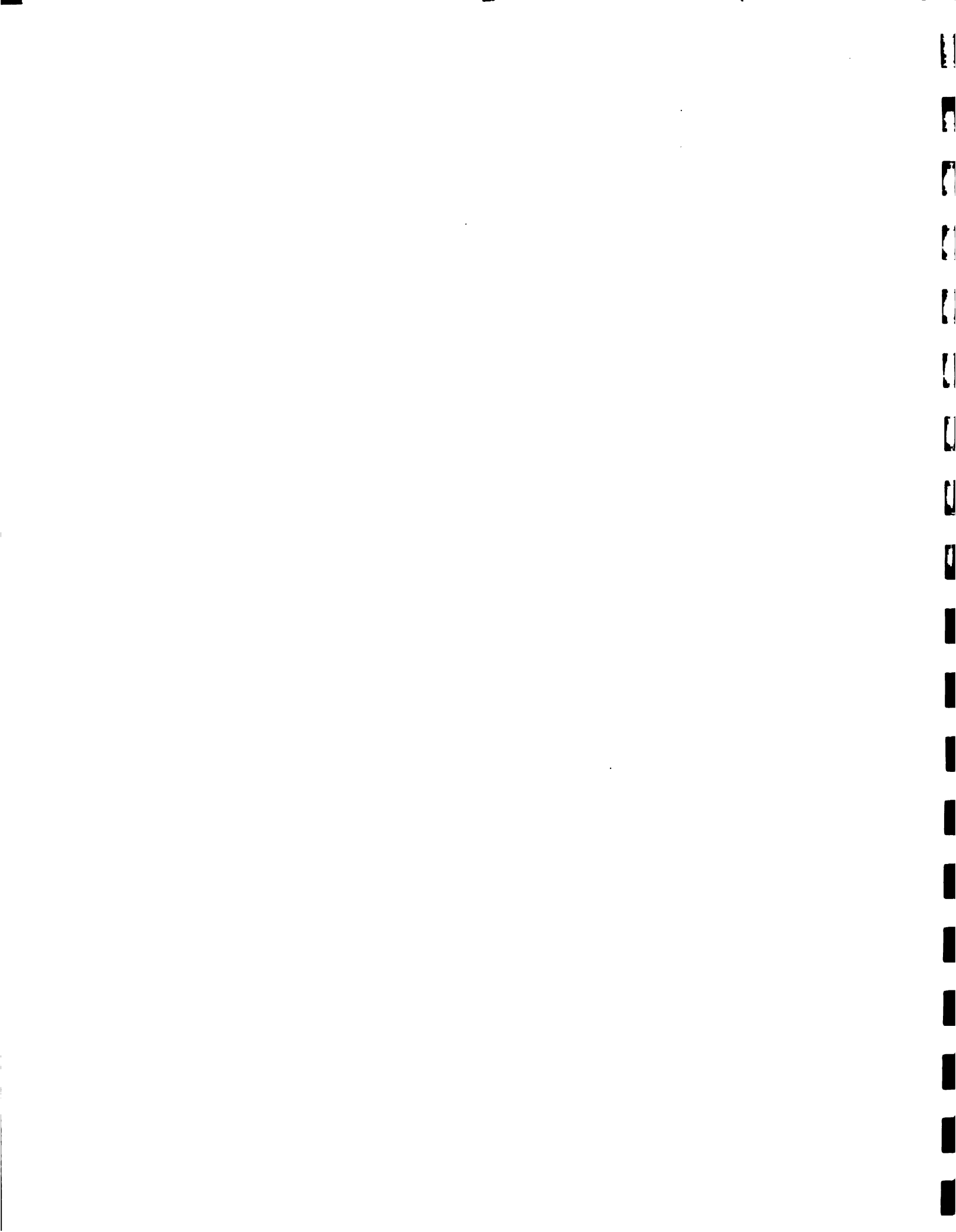


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# **FACILITATION OF CARIBBEAN INTRA REGIONAL TRADE IN FRESH PRODUCE**

## **1.0 INTRODUCTION**

### **1.1 Background**

Recent pest introductions have had a significantly negative effect on trade in agricultural products among the Organization of Eastern Caribbean States (OECS - Antigua and Barbuda, Anguilla, Dominica, British Virgin Islands, Grenada, Montserrat, St Kitts/Nevis, Saint Lucia, St Vincent and the Grenadines) and from these countries to other Caribbean markets (Trinidad and Tobago and Barbados). This problem was discussed at the Seventh Meeting of the Ministers of Agriculture of the OECS held in Tortola, British Virgin Islands in May 1998. Particular concern was expressed regarding the restrictions imposed by some countries on produce from countries declared infested with the Pink Hibiscus Mealy Bug, *Maconellicoccus hirsutus* and Mango Seed Weevil, *Stemochetus mangiferae*.

In 1996, the Caribbean Agricultural Research and Development Institute (CARDI) was mandated to develop Post Harvest Protocols for the revival of trade within the Region at the 19<sup>th</sup> Meeting of the Ministers responsible for Agriculture (SCMA) in Nassau, Bahamas.

In July 1998, the Inter-American Institute for Cooperation on Agriculture (IICA) received a request from the OECS/Export Development and Agricultural Diversification Unit (EDADU) to develop import/export protocols to facilitate the safe movement of fresh produce within the OECS and to its Caribbean export markets. A proposal to address this issue was discussed at the Second planning meeting for the USAID/CARICOM Hemispheric Free Trade Expansion (HFTE) programme in Guyana, July 13-14, 1998. The Meeting agreed that a group comprising representatives of IICA, the Food and Agriculture Organization of the United Nations (FAO) and OECS/EDADU should

review the proposal. This led to IICA convening a two-day meeting in July 1998 in Barbados to begin preparation of protocols. Representatives from IICA, FAO, CARDI and the Ministry of Agriculture in Barbados participated in this initial meeting.

On October 26 and 27, 1998 the Chief Plant Quarantine Officers of CARICOM and the OECS (see Annex II of "Report of the Workshop of Caribbean Chief Plant Quarantine Officers to Discuss Facilitation of Intra Regional Trade in Fresh Produce") for countries represented met in St. Lucia and discussed two draft protocols entitled "*Facilitation of Caribbean Intra Regional Trade in Fresh Produce*" and "*Facilitation of Caribbean Intra Regional Trade in Fresh Produce Due to the Presence of the Pink Hibiscus Mealy Bug*". They agreed to adopt the draft protocols with a few minor revisions.

This document represents the final, accepted version of the general protocol "*Facilitation of Caribbean Intra Regional Trade in Fresh Produce*". It can be used as the basis for developing protocols for specific commodities and specific pests.

## **1.2 Justification**

Owing to the deficiencies in their plant quarantine services and systems, the Caribbean countries have traditionally been very conservative in their importation, adopting a "zero risk" policy. Under the World Trade Organization (WTO) Sanitary and Phytosanitary Measures (SPS) Agreement, this zero risk policy is no longer acceptable, and must be replaced by risk assessment and risk management strategies.

Research conducted by CARDI using direct treatments of methyl bromide or hot water reported 100% mortality on Pink Hibiscus Mealy Bug infested produce. However methyl bromide treatments resulted in extensive phytotoxic damage to a number of commodities including avocado, banana, bluggoe, carambola, golden apple, grapefruit, mango, orange, plantain, plum, sapodilla, soursop, and sugar apple (Pilgrim 1997). This was attributed to the presence of chloropicrin in the formulation of methyl bromide used. The report (Pilgrim 1997) further states that hot water treatments caused a



"small" weight loss to treated commodities (ginger, tannia, dasheen and golden apple) but did not significantly affect other quality attributes of the treated produce (Annex 1). As a result of this and environmental concerns on the use of methyl bromide, CARDI tested a Systems Approach (Jang and Moffit 1994 cited in Pilgrim 1997) for PHMB which integrates the pre-harvest and post-harvest practices used in production, harvest, packaging, distribution and inspection of a commodity which cumulatively meet the requirements for quarantine security. It does not target the product alone but the entire production and marketing system by integrating the activities of the various components.

The general status of pest infestation among Caribbean countries justifies the need to develop and adopt appropriate risk management systems within the production, inspection, treatment and certification mechanisms to facilitate the resumption of trade in agricultural produce while protecting the integrity of non-infested countries. The protocol addresses only commercial trade and does not deal with produce carried in passenger baggage. It describes a general export certification system to arrive at valid and credible phytosanitary certificates. Export consignments certified under the system should meet the current phytosanitary requirements of the importing country.

Certification systems for specific pests and commodities can be developed, based on this general protocol.

## **2.0        PROTOCOL**

### **2.1        Pests of Quarantine Importance**

As a means of facilitating trade, all trading partners (importing and exporting countries) need to share their pest records in order to establish the status of pests (FAO a, e, i) in their countries. Based on the information provided, the importing country can determine through a Pest Risk Assessment (FAO d) the probability of entry of the pest and whether that pest is of quarantine importance. If the pest is of quarantine importance, the importing country would then need to evaluate all the means by which

the pest may enter. This includes produce, and other means by which the pest may be brought into the country. As a result of this, phytosanitary measures that provide the country with effective protection are considered. A list of options for reducing the risk of entry of the pest is outlined and these are evaluated to decide on appropriate phytosanitary measures to prevent the entry of the pest.

This protocol describes activities and options which can be selected to provide effective protection and facilitate the trade in fresh produce.

## **2.2 Systems Approach for Achieving Quarantine Security (Pilgrim 1997)**

The objective of this approach is to reduce the pest population at various stages of the production and marketing systems (Figure 1) and therefore meet the phytosanitary requirements of the importing country. The success of the system depends on the level of management at each stage and the mechanism established to avoid re-infestation. Thus, only activities which are effective in the reduction or elimination of the pest population should form part of the system.

The components of the system and their related activities are described below:

### **2.2.1 Production**

Countries need to be able to validate declarations of the absence or limited distribution of quarantine pests. The collection and recording of information is fundamental. This is achieved through surveillance activities which provide for the different conditions under which production can take place (FAO b). Surveillance activities may be important in the purchase of planting material, if clean material is required.

#### **2.2.1.1 Crop can be grown in**

- a) Country which is free from the pest (FAO b)
- b) Country where the pest is present but not widely distributed, therefore the "pest free area" is used within an infested/infected country (FAO b, Annex 2A)

- c) Country where the pest is present but not widely distributed and the pest is not present in the place the crop is being produced (FAO f, Annex 2B) – “pest free production site”

**2.2.1.2** Crop is not a host of the pest even if the pest is present in the growing area. However, in this respect, consideration should be given to hitchhiking pests such as Pink Hibiscus Mealy Bug.

**2.2.1.3** Crop is grown in infested/infected area

Consider pest management, containment and eradication activities to reduce population or eradicate pest (FAO f). If chemical control method is used, consideration must be given to acceptable residue levels in the harvested produce. The pre-harvest period must be monitored.

Specific survey activities including monitoring of pest population levels must be undertaken. Control measures which give rise to a reduction of pest populations (FAO f) may be necessary. Pest management measures include:

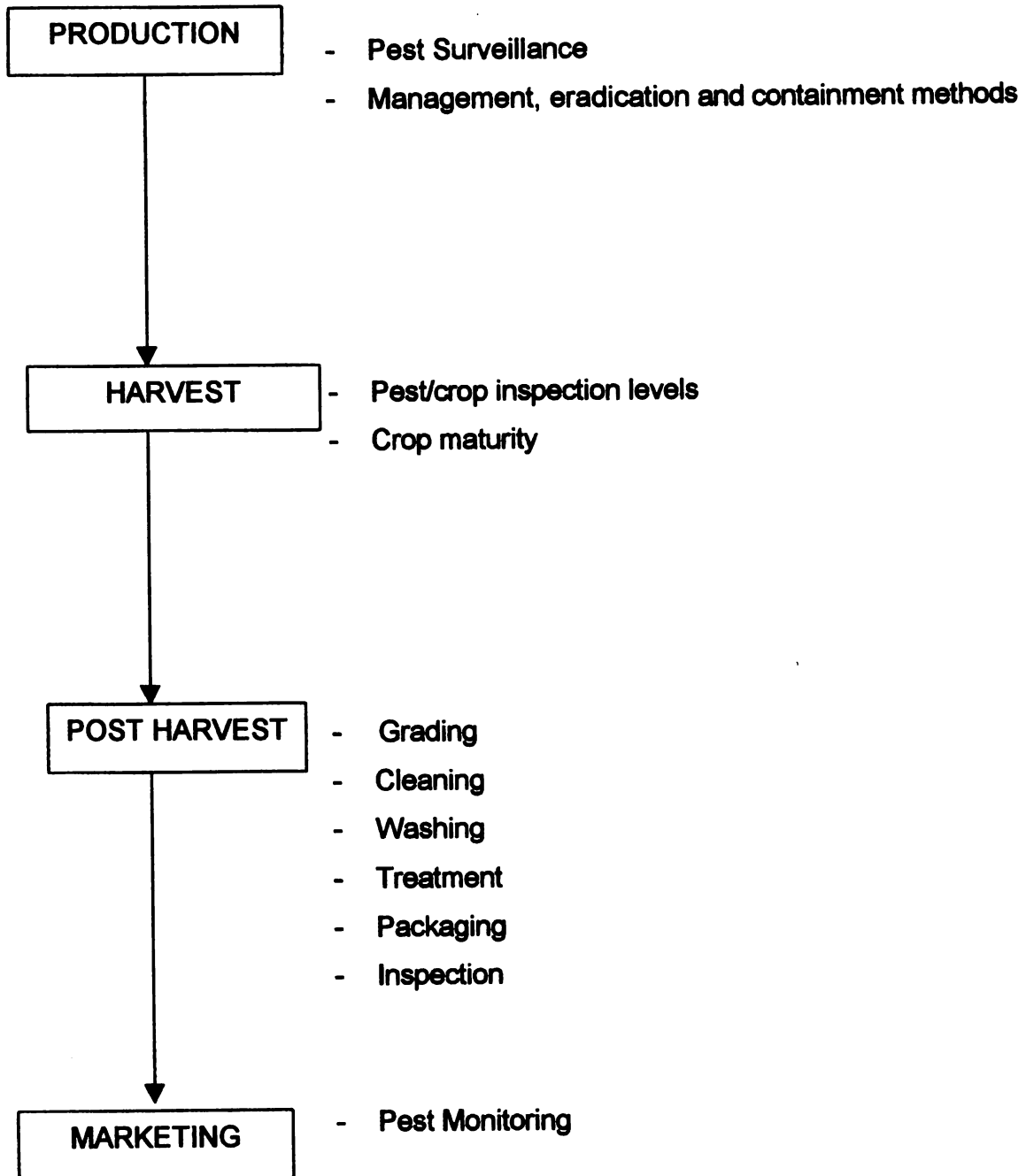
- a) biological control
- b) chemical control
- c) cultural control
- d) mechanical control
- e) resistant varieties

**2.2.2** *Harvest*

**2.2.2.1** Internal feeders

- Produce from a Pest Free Country, Pest Free Area or Pest Free Place of Production in a country: harvest as normal.

**Figure 1: Component levels with some relative activities (Pilgrim 1997)**



- Inspect produce, following the internationally accepted Inspection Methodology (FAO g). The trading partners should determine acceptable sample size. If sample is infested/infected, then the consignment should be rejected.

Other internal pests should be controlled by subsequent direct treatments in the post-harvest component, if produce is to be exported. Harvest only physiologically mature produce from fields.

- Collect harvest produce in field crates used specifically for that purpose.

#### **2.2.2.2 External feeders**

- Produce from a Pest Free Country, Pest Free Area and Pest Free Place of Production in a country: harvest as normal.
- Harvest only physiologically mature produce from fields. Produce that are heavily (1/4 surface area) infested should not be harvested but left on the tree and disposed of during the field sanitation operation.
- Collect harvested produce in field crates used specifically for that purpose.

#### **2.2.3 *Post-harvest***

Applicable to all produce, regardless of place of production.

- Select a site either in the field or away from the packhouse for cleaning the produce. That site must be kept clean, devoid of harvested produce, and disinfected/ disinfested with an appropriate pesticide at the end of each cleaning operation.
- Separate the site into sections
  - a) area for cleaning of the produce
  - b) area for storage of cleaned produce to avoid contamination
- Bring harvested produce directly to the designated site for cleaning
- Do not bring harvested produce directly to the packhouse

The cleaning operation is a critical stage of the post-harvest component. Attempts should be made to physically remove all visible presence and traces of the pest existing on the surface of the produce.

- Clean the produce with a soft brush or pressure hose (water or air) directing attention specifically to areas that may be protected by the physical nature of the produce. These include:
  - around the crevices
  - around the fruit stalk and around the point of attachment of the stalk
  - the distal end of some fruits where the remains of the flower are still attached
  - between fruits that are produced in clusters

Dehusking of dry coconuts totally eliminates the chances of produce contamination. Care must be taken to avoid damaging the produce during the cleaning process.

- Place cleaned produce in clean field crates
- Put in a clean storage area if transportation to the pack house is not immediately available. Do not store cleaned produce in crates used for collecting produce in the field.
- Transport only cleaned produce to the pack house and ensure that the handlers are not the same persons assigned for cleaning the produce.
- At the pack house, submerge produce for 5-10 minutes in washing tank containing a soap solution (5 ml of any soap detergent per 10 gallons water) with bleach (10 ml of commercial bleach containing 5.25% sodium hypochlorite per 10 gallons water). Note that washing will reduce the shelf life of some produce, such as, hot peppers and avocado. **DO NOT WASH SUCH PRODUCE.** Wipe these with a damp cloth.
- Move the produce around in the washing tank ensuring that all the surfaces are in direct contact with the solution and fully wetted. This process involves

brushing of areas that may harbour the pest. This brushing may also involve the same operation as done in the field.

For root crops, care should be taken to avoid damage to the skin.

- Change the washing solution frequently. As a guide, change the water in a washing tank with a 100 gallons capacity after a throughput of 400-600 lb (10-15 cartons) of produce
- Remove produce from the tank, place it on a rack and allow to drip-dry
- Select and sort produce
- Ensure that area around the packhouse is clean to prevent re-infestation/re-infection of the products after washing.
- Remove all rejected produce from the pack house.
- Clean and disinfect/disinfest the packhouse premises and surroundings after the completion of all post-harvest operations.

**Additional treatment that may be necessary for produce from infested/infected areas.**

All the above post-harvest treatments should be carried out before doing those outlined below. Treatments (Annex 3) may involve one of the following:

**Hot Water**

- Place produce in perforated plastic crates
- Dip crates containing produce in water at the specified temperature for the specific pest or produce (48-50°C for 5-10 minutes for Pink Hibiscus Mealy Bug; or 48°C for 35 minutes for Fruit Flies)
- Submerge produce at least six inches below the surface of the water
- Place produce on rack and allow to drip dry
- Pack produce in appropriate cartons

This method is effective against Pink Hibiscus Mealy Bug and fruit flies. Efficacy for other pests or diseases must be tested.

## **Methyl Bromide (MB)**

- Pack produce in cartons or sacks prior to treatment.
- Place the container of produce in the treatment chamber or beneath tarpaulin on pallets
- Treat with MB (rate to be determined depending on pest)
- Ventilate treated produce for two hours

Other treatments will be reported, as they become available.

Ensure that all postharvest operations flow in one direction i.e. from farm to pack house to port (Annex 4), in order to eliminate any possibility of re-infestation/re-infection during handling of the produce.

## **3.0 OTHER CONSIDERATION FOR INTRA REGIONAL TRADE**

### **3.1 Facility**

Treatment facilities (Annex 3) should be centrally located near the ports of exit to facilitate treatment and certification for export.

#### **3.1.1 *Hot Water Treatment Facility***

The interior dimensions of a commercial tank could be about 14ft x 8ft x 2ft, depending on the volume of produce to be treated. This can be managed either by the Government or an Association of Fresh Produce Exporters or similar group. An individual or small group of individuals may utilize a smaller tank of 7ft x 4ft x 2ft (Annex 3A).

#### **3.1.2 *Methyl Bromide Facility***

##### **Chamber**

The treatment facility comprises of an airtight chamber with a minimum size of 1000 ft<sup>3</sup> with a height not exceeding 8 ft (Annex 3B).



Tarpaulin

A tarpaulin can be used to make a temporary enclosure to hold the fumigant.

### **3.2 Public Awareness**

Owing to the varied nature of the intra-regional trade (huckster/trafficker) operations in the islands, the application of the Systems Approach must be fully appreciated by all involved in the trade. All participants in the trade must be sensitized to the need to avoid re-infestation/re-infection of the produce at all stages of the handling process.

### **3.3 Standard**

#### **3.3.1 Quality**

The quality shall be one minimum quality standard defined as follows:

The product should be clean, free from damage, free from disease or pest infection/infestation. It should be firm and packed in properly labelled packages of correct packed weight which should vary from 9kg (20 lb) to 18.2kg (40 lb).

- Clean - free from dirt, foreign material and odours
- Damage: no harvest wounds, bruises or punctures which would lead to quick deterioration and cause rejection by consumers
- Disease : any sign of growth of fungus, bacteria or the development of dry or soft spots
- Pest: live or dead insects or other arthropods at any stage of development present in or on the produce or package
- Firm: not soft or without soft spots
- Label: Name and address of exporter and consignee, name of produce, country of origin, weight of package

Standard package recommended for packaging fresh produce traded within the region is a full telescopic two piece fibre board carton (banana type) with internal dimensions about 20cm x 53cm x 33cm (8" x 20" x 13"). This carton is manufactured in the OECS. Sacks can be used for coconuts and pumpkins.

- Clean carton fully protecting its contents

- Single carton should be used

### **3.3.2 Seal**

An appropriate seal or stamp will be the final approval of export quality and quarantine security required.

## **4.0 SANITATION OF CARRIERS AND HANDLERS**

- Clean and disinfect/disinfest facilities (trucks/vans, cargoholds of boats and aircrafts) used for the transportation of the produce with an appropriate pesticide prior to loading
- Do not allow persons coming from infected/infested fields to handle (loading or off loading) the treated produce
- Do not mix or put untreated produce in the same cargo hold as treated produce

## **5.0 QUARANTINE INSPECTION (FAO g)**

A pre-export inspection must be done by the Quarantine Officer of the exporting country to ensure that the phytosanitary requirements of the importing country are met before the produce is exported. Initially, the pre-clearance activity may include the Quarantine Officer of the importing country until confidence in the certification procedure and efficacy of inspection by the Quarantine Officers of the exporting country are ensured.

If certification is done at the pack house, the produce should be protected from infestation/infection by covering during transportation. A sample size for inspection can be agreed on by the trading countries.

The standard carton discussed above allows for ease of quarantine inspection.

The National Plant Protection Organisation (NPPO) has responsibility and authority for phytosanitary certification of produce. If any non-governmental personnel are accredited to carry out this function, such personnel should be qualified and skilled and

responsible to the NPPO. To ensure impartiality, these persons should be subject to restrictions equivalent to those for government officials and have no financial interest in the outcome.

The information concerning inspection procedures determined for a commodity should be documented and given to the parties concerned. This may be a part of a bilateral agreement covering the phytosanitary aspect of a commodity trade. Records should be kept to validate activities and for "trace back".

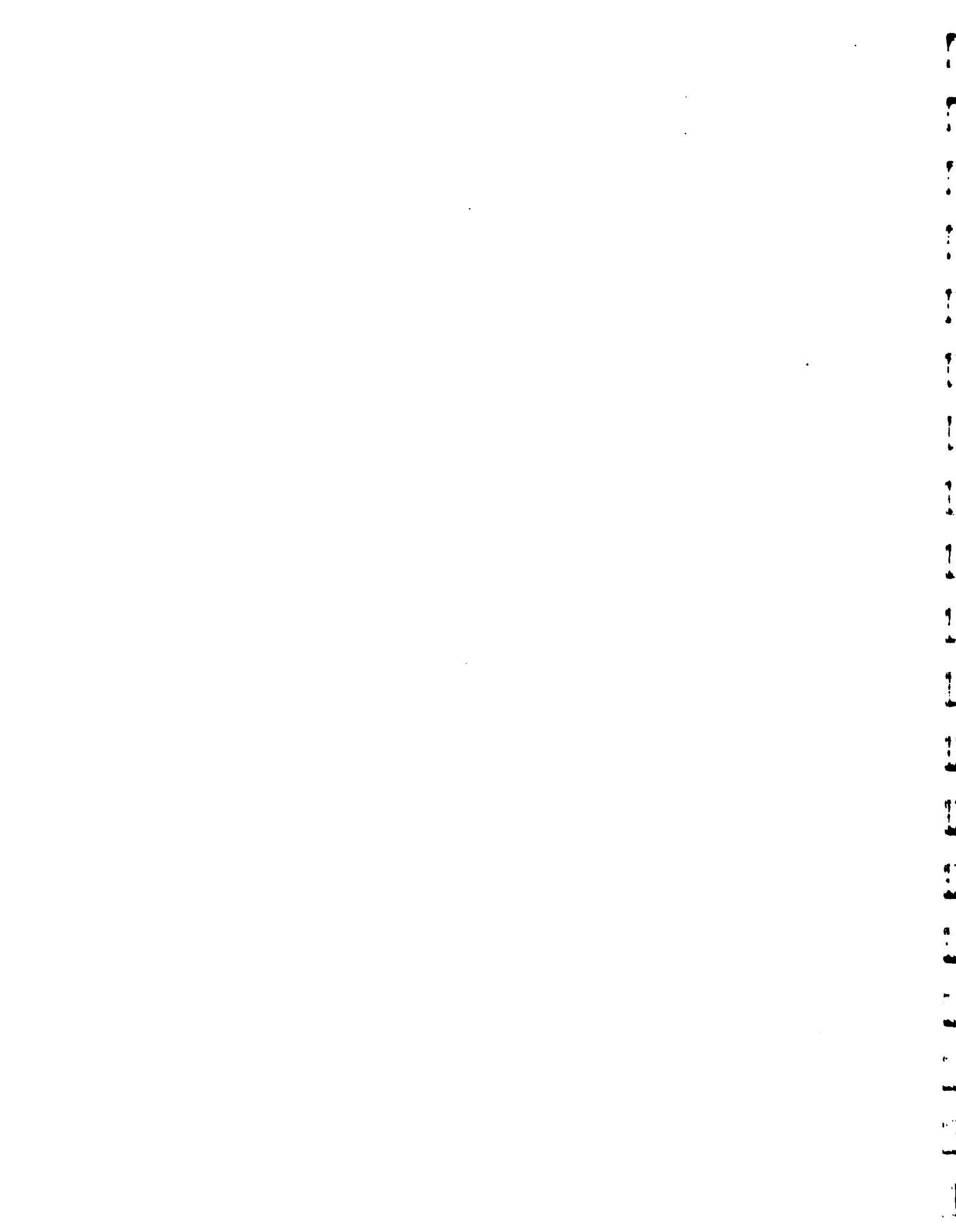
In addition to visual inspection, other procedures in phytosanitary management systems may be necessary. These include taking of samples for laboratory testing which follows the same principles as visual examination. Other procedures include field inspection of growing plants or places of production, preparation and issuance of documents such as Phytosanitary Certificates, field inspection data and audit arrangements by the inspector or NPPO.

A mechanism should be set up to review the effectiveness of all aspects of the export certification system and implement changes where necessary. Investigation of reports from importing countries of non-conforming consignments covered by a phytosanitary certificate may be done by a technical team from the importing and exporting countries and, if necessary, an independent country or organisation.

## **6.0 REFERENCES**

- Jang, E.B. and H.R. Moffit (1994) Systems Approaches to Achieving Quarantine Security in Quarantine Treatments for Pests of Food Plants 1994. pp. 225-247 cited in Pilgrim, R.N. (1997) A Systems Approach to Achieve Quarantine Security of the Pink Mealy Bug for the Revival of Inter-Regional Trade. CARDI 14pp + 19pp Appendix.**
- Polius, J.N. and Ambrose, E. (1996) Proceedings of a Caribbean Regional Meeting on the Pink Mealy Bug and its impact on the Fresh Produce Trade. Castries, Saint Lucia. IICA. ISSN 0253-4746. 17pp + 8pp Annex.**
- Pilgrim, R. N. (1997) A Systems Approach to Achieve Quarantine Security of the Pink Mealy Bug for the Revival of Inter-Regional Trade. CARDI 14pp + 19pp Appendix**
- International Standards for Phytosanitary Measures Secretariat of the International Plant Protection Convention (FAO)**
- a) Guidelines for Surveillance 1998. 12pp**
  - b) Part 4 Pest Surveillance Requirements for the Establishment of Pest Free Areas 1996. 15pp**
  - c) Export Certification System 1997. 13pp**
  - d) Part 1 import Regulations Guidelines for Pest Risk Analysis 1996. 21pp**
  - e) Determination of Pest Status in an Area. Draft 1997. 14pp**
  - f) Guidelines for Pest Eradication Programmes. Draft 1997. 11pp**
  - g) Inspection Methodology Draft 1997. 13pp**
  - h) Requirements for the Establishment of Pest Free Places of Production. Draft 1997. 9 pp.**
  - i) Principles of Plant Quarantine as related to International Trade. 1995 11pp**

# ANNEXES



**Annex 2A: Criteria for a Pest Free Area (Pollus and Ambrose 1996)**

A pest free area is one in which a specific pest does not occur as demonstrated by scientific evidence and in which, where appropriate, this condition is being officially maintained. The establishment and use of a pest free area by a National Plant Protection Organization provides for the export of plants, plant products and other regulated articles from the country in which the area is situated (exporting country) to another country (importing country) without the need for application of additional phytosanitary measures when certain requirements are met (FAO b).

Within the past three months, the Plant Protection Service of the exporting country has established the absence of infestations in the area based on specific surveys performed in accordance with requirements adequate to detect infestations.

The exporting country has adopted and is enforcing phytosanitary requirements to prevent the introduction into the area that are deemed to be at least equivalent to those requirements imposed to prevent such introduction into the country of injurious pests from other countries.

The Plant Protection Service of the exporting country has submitted to the importing country written detailed procedures for the conduct of surveys and enforcement of requirements to prevent the introduction of the pest.

The area has been certified by a technical team as agreed on by the trading partners.

Detailed records are kept and made available for scrutiny.

**Annex 1: Commodity Response to Hot Water and Methyl Bromide (MB) Treatment (Pilgrim 1997)**

COMMODITY	TREATMENTS	DAMAGE
Avocado	Hot Water	Yes
Avocado	MB	Yes
Banana	Hot Water	No
Banana	MB	Yes
Bluggoe	Hot Water	No
Bluggoe	MB	Yes
Carambola	Hot Water	Yes
Carambola	MB	Yes
Dasheen	Hot Water	No
Dasheen	MB	No
Dry Coconut (dehusked)	Hot Water	No
Dry Coconut (dehusked)	MB	No
Eddoe	Hot Water	No
Eddoe	MB	No
Ginger	Hot Water	No
Ginger	MB	No
Golden Apple	Hot Water	No
Golden Apple	MB	Yes
Grapefruit	Hot Water	Yes
Grapefruit	MB	Yes
Mango	Hot Water	No
Mango	MB	Yes
Orange	Hot Water	Yes
Orange	MB	Yes
Plantain	Hot Water	No
Plantain	MB	Yes
Plum	Hot Water	Yes
Plum	MB	Yes
Sapodilla	Hot Water	No
Sapodilla	MB	Yes
Soursop	Hot Water	No
Soursop	MB	Yes
Sugar Apple	Hot Water	Yes
Sugar Apple	MB	No
Sweet Potato	Hot Water	No
Sweet Potato	MB	No
Tannia	Hot Water	No
Tannia	MB	No
White Potato	Hot Water	No
White Potato	MB	No
Yam	Hot Water	No
Yam	MB	No



**Annex 3A: Hot Water Treatment (HWT) Facility**

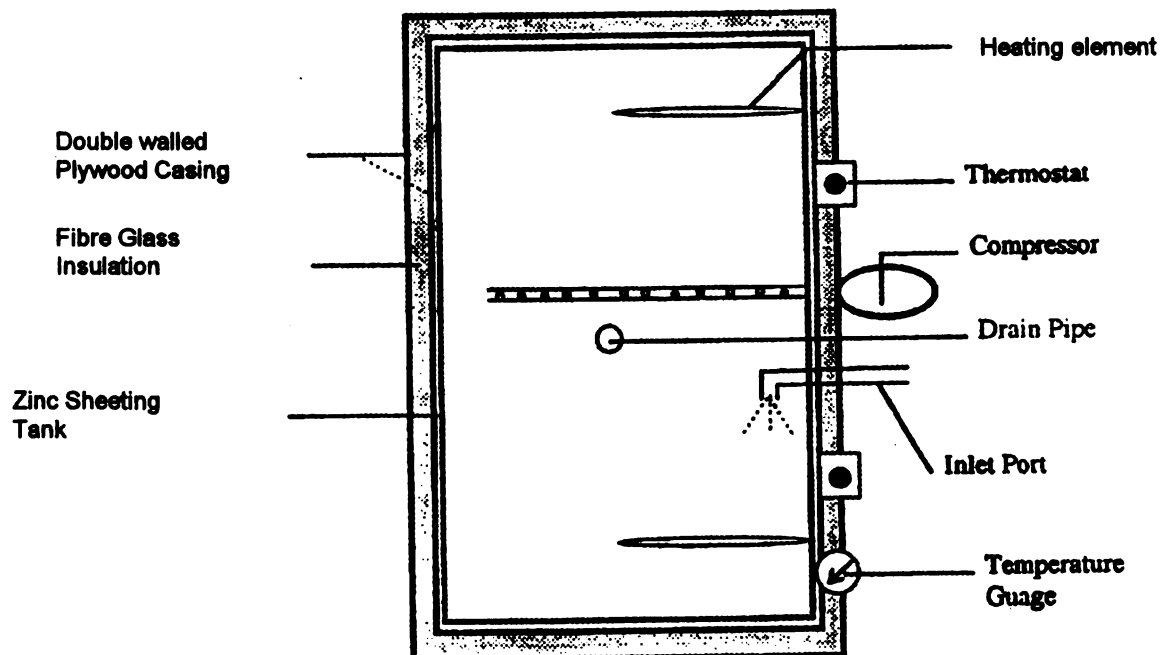
**Location:** Marc - St. Lucia

**Packhouse Operator (Exporter):** Danny Brown

**Tel No.** 1-758-451-2544

**Design**

**Internal dimensions:** 7.0 ft long x 4ft 2 inches wide x 2 ft deep



- Hot water enters through inlet port from an 80 gallon Solar Heater
- Water is circulated in the tank by a compressor which bubbles air through the water in order to obtain a uniform temperature.
- Temperature is regulated by two thermostats and monitored with a thermometer.

## **Annex 2B: Criteria for Pest Free Place of Production**

A pest free place of production is one in which a specific pest does not occur as demonstrated by scientific evidence and in which, where appropriate, this condition is being officially maintained for a definite period. It provides a means for an exporting country, if so required by an importing country, to ensure that consignments of plants, plant products or other regulated articles produced on, and/or moved from the place of production area free from the pest concerned, because it has been shown to be absent from that place over a relevant period of time (FAO).

During the growing season or development of the produce, the Plant Protection Service of the exporting country has established the absence of infestations in the crop and place of production based on specific surveys and inspection during the growing season performed in accordance with requirements adequate to detect infestations.

The exporting country has adopted and is enforcing phytosanitary requirements to prevent the introduction into the place of production that are deemed to be at least equivalent to those requirements imposed to prevent such introductions into the country or area of injurious pests from other countries or areas.

The Plant Protection Service of the exporting country has submitted to the importing country written detailed procedures for the conduct of surveys and growing season inspection and enforcement of requirements to prevent the introduction of the pest.

The area has been certified by a technical team as agreed on by the trading partners.

Detailed records are kept and made available for scrutiny.

## Annex 3B: Methyl Bromide Facility

### Site Selection

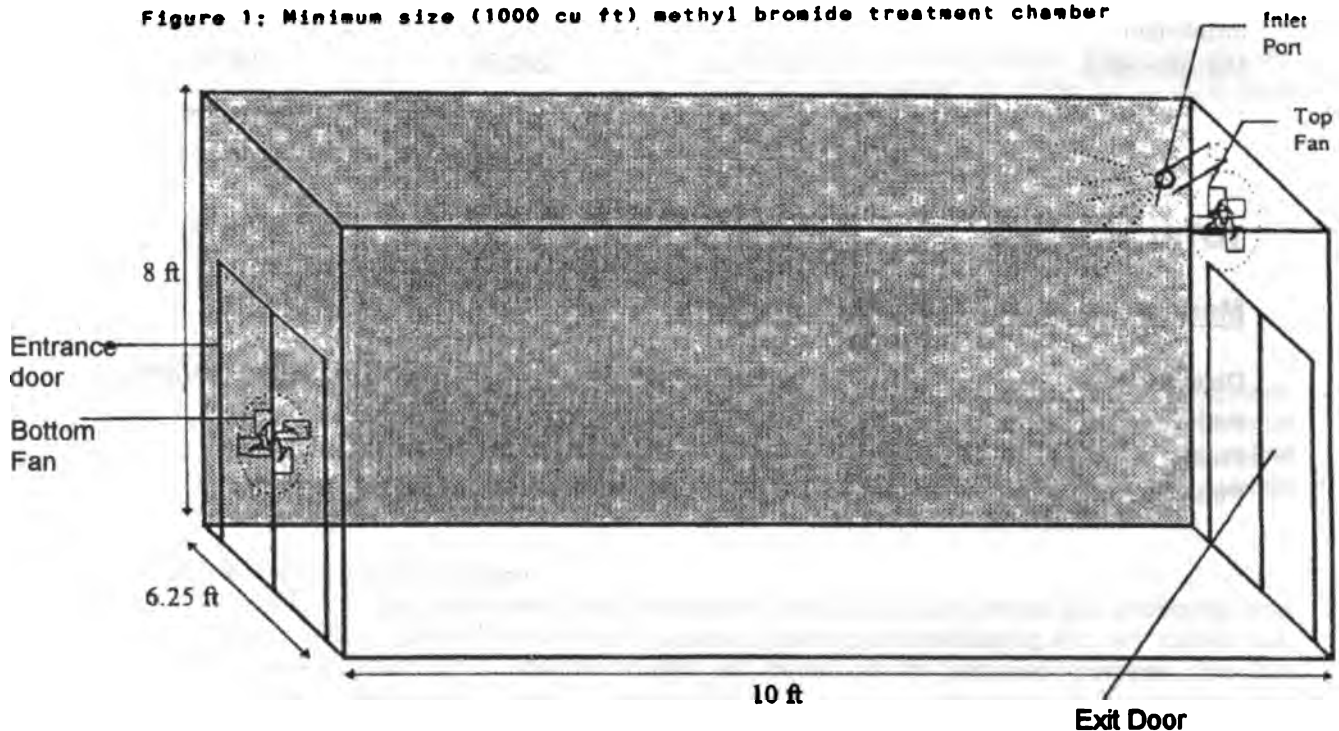
Ideally the chamber should be located on a concrete platform in an area away from normal human activity and flooding. This is necessary in order to avoid any inhalation of toxic fumes during the ventilation phase or from leakage that may accidentally occur during the treatment phase.

#### 1. MB Treatment Chamber

The treatment facility comprise of an air-tight chamber with a minimum size of 1000 cu. ft. with height not exceeding more than 8 ft. (Figure 1 gives the requirements for such a chamber). Doors should be located at the front and back of the chamber to facilitate easy flow of air and produce. Doors must be constructed so that they open and close from the outside. The chamber should be oriented in such a manner that there is a free flow of air through the facility during the ventilation stage. This is achieved if doors are located on both windward and leeward sides. The height and width of these doors must be large enough to accommodate the passage of a standard forklift and pallet. Doors must also be tightly fit to prevent escape of the fumigant.

A minimum of two (2) electric fans must be installed inside the chamber, one located to the top and the other at the bottom end to ensure proper air circulation. An inlet port for introduction of the fumigant must be located directly above and in front the upper fan. Figure 1 gives the specifications and requirements for a minimum size (1000 cu. ft.) methyl bromide treatment facility.

Figure 1: Minimum size (1000 cu ft) methyl bromide treatment chamber



**Annex 3A Cont'd****Material Cost**

<b>Materials</b>	<b>Quantity</b>	<b>Unit Cost (EC\$)</b>	<b>Total Cost (EC\$)</b>
¾" Plywood (4' x8')	3	90.00	270.00
Fibre glass insulation		300.00	300.00
1/8" Zinc sheeting (4'.2" x 9'.6")	2	465.00	930.00
Heating elements	2	35.00	70.00
Thermosat	2	55.00	110.00
Compressor (refrigerator)	1	250.00	250.00
Solar heater (80 gallons)	1	4820.00	4820.00
5/16" steel rods (grill baskets)		450.00	450.00
½" PVC pipe (10')	5	60.00	60.00

Sub-total **7260.00**

**Labour Cost**

Construction	600.00	600.00
Installation	400.00	400.00
Miscellaneous	200.00	200.00

Sub-total **1200.00**

**TOTAL**

**EC\$ 8460.00**

**Mango Hot Water Treatment Proposal**

<b>Disease/Pest</b>	<b>Temperature (°C)</b>	<b>Exposure period (minutes)</b>
Anthracnose	53	5
Fruitfly	48	35
Pink Mealybug	50	10

**Alternatives:** Various modifications of treatment chamber can be constructed or improvised depending on what is locally available. What is required is an air-tight chamber, the size of which is dependent on the volume of produce to be treated at any given time and scheduling of treatment.

**2. Packaging**

Avoid using plastic wrappings such as cellophane and films and paper that are waxed, laminated or waterproofed. If used they should be perforated or removed before fumigation. Produce should preferably be fumigated in perforated corrugated cartons, wooden crates or sacs. Other containers, if used, must be left open or uncovered to allow for penetration of the fumigant.

Some farmers/exporters who usually carry out the necessary post harvest activities at their homes rather than at a centralized pack house, need to package their produce in cartons before taking produce to treatment site.

Exporters need to standardize their packaging to facilitate the proper stacking of pallets used. The normal 40 lb. banana type carton is preferred as this is the most popular type of package used for regional trade.

**3. Stacking**

When stacking the produce in the chamber, a space of 18 inches above and 2 inches below the commodity must be produced during stacking to allow for free circulation of the fumigant. Pallets are ideal for stacking as they allow for free flow of air along the floor and between the commodity. Allow 1-2 inches between pallets and arrange pallets evenly for proper distribution of the fumigant. The amount of produce being treated should not exceed over 2/3 the volume of the chamber.

**4. MB Treatment Dosage**

The recommended application rate of methyl bromide for the post-harvest treatment of fresh produce is 1.50 lb./100 cu. ft. for 2 hours, after which the chamber including the produce must be ventilated for 2 hours.

The formula for calculating the dosage:

$$\text{Dosage} = \frac{\text{volume (ft.)}^3 \times \text{dosage rate (lb)}}{1000}$$

**5. Ventilation Phase**

This phase allows the gas inside the chamber to escape into the surrounding atmosphere. Chamber doors should be opened and fans turned on, to allow the chamber and produce to be ventilated for 2 hours. This process should be done carefully with the persons responsible wearing protective gear (gas masks) and making sure the surrounding area is clear of other people. Produce could be safely removed from the chamber after 2 hours of ventilation.

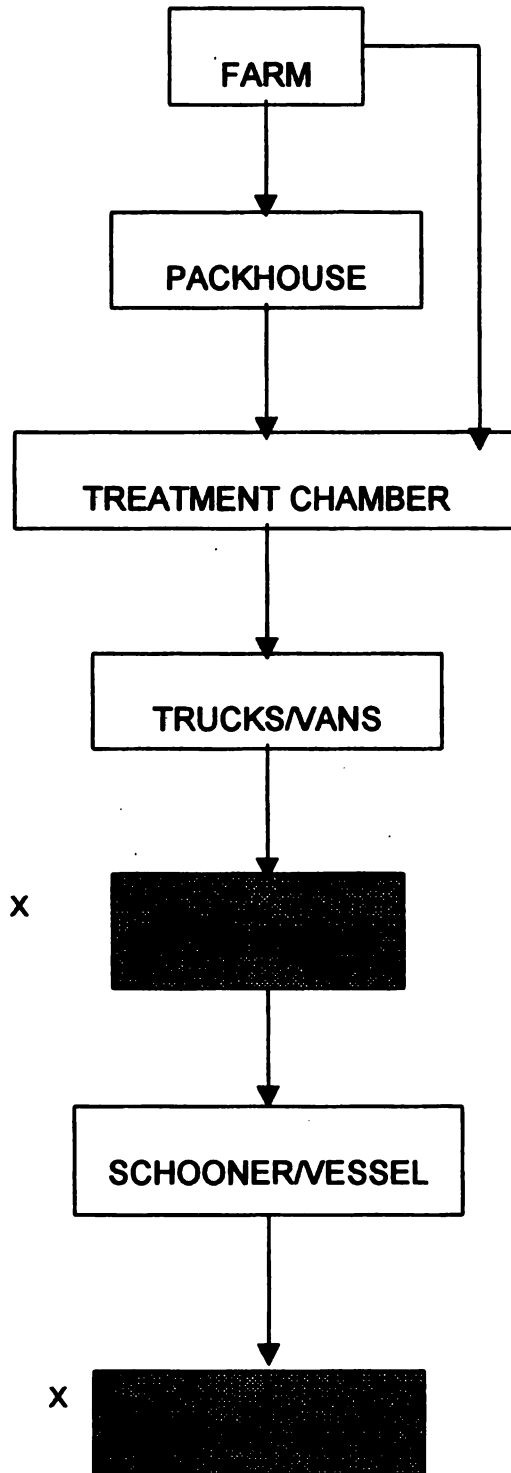
**6. Produce Flow and Logistics**

Produce should be transported from the field to the pack house where the necessary post harvest handling activities of selection, washing, grading and packaging etc. are carried out. The packed produce should then be brought and loaded into the treatment chamber. The flow of produce for treatment must be carried out in such a manner that it enters through the front door of the chamber and leaves through the exit door. This is necessary in order to avoid re-infection of the produce. The MB treatment should always be the final stage of the chain of activities to ensure PMB free produce.

From the chamber, the produce is loaded on to vehicles which have been previously disinfected with a pesticidal spray before being brought to the port of exit, where it is loaded on to schooner

vessels or aircraft. Annex 4 outlines the logistical flow of produce and critical points of re-infection.

**Annex 4: Produce flow and logistics with critical points (X) of inspection (Pilgrim 1997)**



**Annex 5: Treatment schedules**

**Various Commodities**

**Pest: Mealybugs**

**Treatment: T104-a-2 MB at NAP-tarpaulin or chamber<sup>1</sup>**

<b>Temperature</b>	<b>Dosage Rate (lb/1,000 ft<sup>3</sup>)</b>	<b>Minimum Concentration Headings (ounces) at</b>	
		<b>0.5 hr</b>	<b>2 hrs</b>
80°F or above	2.5 lbs	32	24
70-79°F	3 lbs	38	29
60-69°F	4 lbs	48	38

**IMPORTANT:** \* To comply with dosage restrictions imposed by the methyl bromide "Q" label, the following temperatures (the items bolded are under Section 18 Exemption)

60°F or above (maximum dosage, 4 pounds/1,000 ft<sup>3</sup>):

Apple, apricot, asparagus, **banana, blackberry**, cabbage, cantaloupe, **celery**, chayote, cherry, chestnut, chichory, cipolini, cucumber, **dasheen, endive**, fava bean (dried), grape, **fresh herbs**, honey dew melon, kiwi, **leafy vegetables**, muskmelon, nectarine, peach, pepper, pineapple, plantain, plum, raspberry, squash (summer, winter), stone fruit, sweet potato, water melon.

70°F or above (maximum dosage, 3 pounds/1,000 ft<sup>3</sup>):

Bean, beet, carrot, **cassava**, citron (ethrog), coconut, corn-on-the-cob (sweet corn), eggplant, garlic, **ginger root**, grapefruit, green pod, vegetables, horseradish, Jerusalem artichoke, kumquat, lemon, lime, okra, onion, orange, parsnip, potato, radish, rutabaga, salsify, scallion, shallot, strawberry, sugar beet, tangelo, tangerine, tomato, turnip.

80°F or above (maximum dosage, 2.5 pounds/1,000 ft<sup>3</sup>):

Pimento, pumpkin, zucchini

<sup>1</sup>**Source – Treatment Manual USDA–Treatment Schedules T100–Schedule for fruits and vegetables**





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