

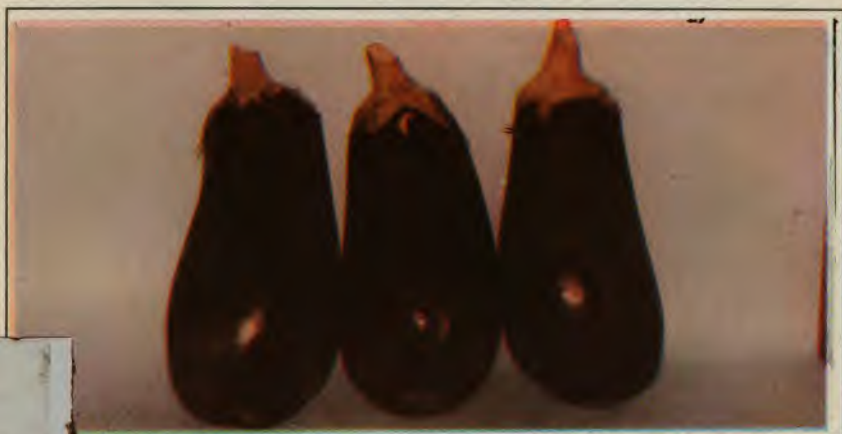
JULY, 1989

IICA-CIDIA

A Post Harvest Handling System for

MELONGENES

(Solanum melongena)



RESEARCH DIVISION

MINISTRY OF FOOD PRODUCTION AND MARINE EXPLOITATION

IICA



INTER-AMERICAN INSTITUTE FOR COOPERATION ON AGRICULTURE
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What is IICA?

The Inter-American Institute for Cooperation on Agriculture (IICA) is the specialised 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 recognised 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 contribution 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 subregional integration.

In order to attain these goals, the Institute is concentrating its actions on the following five programmes: Agricultural Policy Analysis and Planning; Technology Generation and Transfer; Organisation 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 organisations.

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**A POST HARVEST HANDLING SYSTEM FOR
MELONGENE**

Corrections to this Manual

Foreword - Page iii

5th Paragraph

... there is limited information on
tropical vegetable crops.

Preface - Page iv

... in other developing countries
where Melongene assumes importance.

Page 18 - Plate 15

1. Bacterial soft rot caused by
Erwinia

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FOREWORD

Improvement in food self-sufficiency and food security in Trinidad and Tobago will depend, to some extent, on improvements in the marketing system for food crops. In 1985, the Government of Trinidad and Tobago requested IICA's assistance in the preparation of project proposals for establishment of a marketing system for food crops which would embrace aspects of packaging, handling and postharvest technology.

A mission visited Trinidad and Tobago from August 25th to 31st, 1985 and prepared proposals for the improvement of domestic marketing of fruits and vegetables in Trinidad and Tobago.

On the subject of Research and Training the mission observed that "a national course in postharvest technology and marketing seems necessary."

In pursuing the implementation of the proposed national course in postharvest technology, it became clear that local materials for use in postharvest training were extremely limited. In view of this, IICA sought to assist in the preparation of local training material for use in a national course in postharvest technology and marketing. This publication on the postharvest technology of melongenes (*Solanum melongena*) is the result of joint efforts by IICA and scientists of the Ministry of Food Production and Marine Exploitation to prepare local materials which can be utilized in training programmes designed to improve the marketing systems and reduce postharvest losses in food crops.

This publication is timely and important because, while there is abundant literature on postharvest technology of temperate fruit crops, there is limited information on tropical root crops.

I hope that this continues a series on the postharvest technology of tropical crops which will have application not only in Trinidad and Tobago, but throughout the tropical world. Our Institute is pleased to have collaborated with the Ministry of Food Production and Marine Exploitation in this venture and looks forward to co-operating in future initiatives which will contribute to reducing postharvest losses in tropical crops.

"The responsibility for the opinions expressed in this publication rests solely on the author."

Representative
IICA Office in Trinidad and Tobago

PREFACE

Developing countries often find themselves in the situation where locally grown produce arrives on domestic markets in less than excellent condition and attempts at marketing in the potentially lucrative markets of North America and Europe encounter problems of quality, both from the quarantine viewpoint and overall quality standards.

The goal of achieving a developed marketing system which satisfies both domestic and foreign requirements has remained somewhat elusive for many a tropical developing country.

The reasons for the above condition are varied, amongst them being the lack of a well informed farming community highly sensitive to the need to produce a quality product and willing to engage in the steps necessary to ensure good product life and final consumer acceptance.

It is towards the fulfilment of this condition that this series of manuals directs attention. They attempt to put together the various techniques (generally grouped together as "post harvest technology") that must be applied to a particular commodity not only to ensure quality but minimize total product loss.

The series treats the problems of perishables, more particularly the commodity groupings (1) Fruits, (2) Vegetables, (3) Roots and Tubers, and (4) Ornamentals. The approach consists of an examination of the operations that occur between harvest and market, identification of common problem areas and practical recommendations to the grower/handler.

Although intended for the grower and Extension Officer mainly, it is hoped that it can also be a useful source of information for administrators, entrepreneurs, etc., and even our colleagues in temperate countries with an interest in the post harvest technology of tropical perishables.

This manual is one in the series resulting from the joint efforts of IICA, Trinidad and Tobago Office and the Post Harvest Unit of the Ministry of Agriculture (MOA), Trinidad and Tobago.

It is hoped that the package of technical information provided is supportive not only of the Government of Trinidad and Tobago's efforts in the area of improved marketing but attempts in other developing countries where cassava assumes importance.

It is hoped that critical comments and suggestions especially in the area of new and improved post harvest techniques for the small to medium sized grower would be part of a constant feedback from users throughout this series.

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Crop Research Sub-Division

**A POSTHARVEST HANDLING SYSTEM FOR
MELONGENES (*Solanum melongena*)**

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1.0 INTRODUCTION

Melongene, also known as eggplant or baigan or in some Asian countries as brinjal is an extremely popular vegetable in Trinidad and Tobago but one where the problem of over supply coupled with low prices exist in dry periods and the converse in the wet period. It is also a commodity identified as a foreign exchange earner in the agricultural export thrust.

The introduction of an effective handling system combining rapid post harvest cooling, suitable packaging materials and the use of adequate storage conditions would no doubt extend the availability of this vegetable on the local market. This would also permit prediction of post-harvest storage life, a key factor in managing the commodity for export marketing.

Quality loss in melongene like other perishables begin in the field immediately after harvest and continues throughout the various operations such as infield holding, transport, sorting, packing and distribution. The extent to which quality loss is prevented depends upon the care taken in carrying out the above operations. The combination of techniques outlined in this manual provides a suitable handling system for melongene (*Solanum melongena*).

2.0 VARIETIES AND VARIETY SELECTION

There are a number of varieties in cultivation, both for edible and for ornamental use. References are made in this manual only to the edible varieties. These varieties e.g. "Florida Market" (Plate 1), "Long Violet" (Plate 2). "La Pastora Local" (Plate 3), Pompano Market" (plate 4) and "Long Purple" (Plate 5), vary in shapes and sizes. Both domestic and export

markets require fresh looking melongenes with a black-purple skin, a green stem and calyx, that is clean, free from diseases as well as skin discolourations and sunburn markings. The pulp should be firm and the seeds should not be excessively hard.



Plate 1 - *Florida Market*

3.0 HARVEST

3.1 Maturity

The stage at which melongene should be harvested can be difficult to identify at first. Melongenes are initially very dark purple when immature, and when fully ripe very pale in colour. In between these two conditions is the harvesting stage. Melongenes begin to lighten from the tip and this paling of colour gradually extends back towards the calyx. Harvesting of melongenes is best when this lightening is first seen, although it can be left on the plant for up to a week after this without loss of quality. Melongenes left beyond this time become pale and unattractive (Plate 6). Premature



Plate 2 - 'Long Violet'



Plate 3 - 'La Pastora Local'

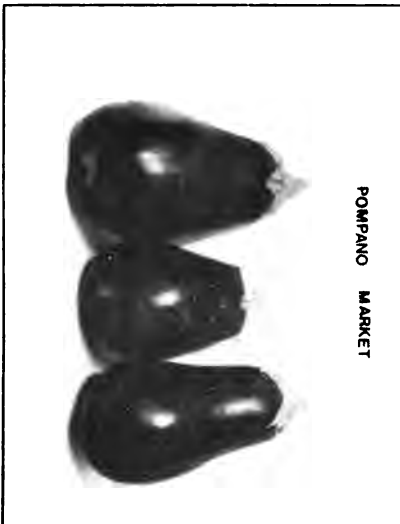


Plate 4 - 'Pompano Market'



Plate 5 - 'Long Purple'

melongenes wrinkle and soften quickly, and have a much reduced shelf-life.



Plate 6 - Over matured melongenes with pale and unattractive skin.

3.2 Harvesting Method

Melongenes are manually harvested, on a weekly basis but it is likely that the harvesting interval can be extended to two weeks provided no melongenes are missed. The melongenes are cut from the plant with a knife or secateur, leaving a section of the stalk and the fleshy calyx intact (Plate 7). Care must be taken to ensure that the spines on the calyx do not damage the surface of adjacent melongenes.



Plate 7 - Melongene being harvested from plant.

3.3 Harvesting Containers

Appropriate harvesting containers reduce damage as well as total harvest time. Table 1 outlines the advantages and disadvantages of containers used for harvesting. Four very important factors to consider in the selection of a harvesting container are:

1. The size and flexibility of the containers (too large and flexible can cause squeezing)
2. The form (it should facilitate carrying or hanging).
3. The surface should be smooth to avoid cuts and abrasions.
4. The price should not be too expensive in relation to the value of the commodity.
5. Harvesting containers should be of a light colour to reflect as much sun rays as possible.

TABLE I

Advantages and Disadvantages of Different Types of Harvesting Containers.

Type of Container	Advantages	Disadvantages
1. Metal Buckets	(a) durable (b) can be used of for a wide range produce	(a) Expensive (b) Heavy (c) Does not cater for large quantities (d) Rust—can affect quality of produce (e) Not ventilated

TABLE I cont'd

Advantages and Disadvantages of Different Types of Harvesting Containers.

Type of Container	Advantages	Disadvantages
2. Wooden Crates	(a) can be stacked (b) light (c) easy to make or repaired (d) durable (e) can be ventilated	(a) Broken pieces of wood can puncture produce (b) Encourages overpacking (c) Rough surfaces may induce abrasions etc. on produce
3. Jute Bags	(a) light (b) inexpensive	(a) Poorly ventilated (b) Allows over- packing (c) Can be torn or ripped easily (d) Can be water soaked
4. Polystyrene Bags	(a) light (b) inexpensive (c) cater for large quantities (d) water resistant (e) reusable	(a) Poorly ventilated (b) Poor stacking of produce (c) encourages overpacking and bad handling practices
5. Baskets	(a) cater for large quality of produce (b) available (c) Utilised for wide range of commodities	(a) Too deep (b) Unstable bottom (c) Lacks rigidity (d) Lacks sufficient ventilation

3.4 Temperature Management in the Field

The temperature of the melongene on the plant follows closely the air temperature movement during the day and, once in containers, temperature changes slowly. Therefore, harvesting should be done when temperatures

are lowest, which is generally in the early morning or late in the evening. Harvested melongenes are subjected to moisture loss particularly so, if left in the sun or exposed to breeze. Limit moisture loss and shrivelling by:

1. protecting melongenes under a shady tree or a ventilated shelter
2. covering containers with produce with fresh banana leaves or a damp cloth.

4.0 PRECOOLING

Melongenes should be cooled promptly and rapidly after harvest. This allows the removal of "field heat" resulting in a reduction in the growth and spread of potential diseases, a reduction of water loss and the easing of the load on the cooling system of transport vehicle where long distance transport is necessary and where refrigeration is used as in the case of export marketing. Cheap methods of precooling produce are:

1. placing harvested produce in cold water e.g. nearby river or stream (Plate 8).
2. Frequent sprinkling with clean fresh water.
3. exposing harvested produce to overnight cool temperature.



Plate 8 - *Melongene* fruits being washed and precooled in nearby stream after harvesting.

5.0 GRADING AND STANDARDIZATION

Melongenes can be graded into two main classes, Classes I and II. However there can be provision for a Class III of lower marketable quality, which can be introduced if supplies in the higher classes are inadequate to meet consumer requirements.

Class I

This class includes melongene that are:

1. not less than 20cm nor more than 35 cm in length.
2. diameter should not exceed 10cm although up to 15 cm usually are still tender.
3. between 225-400 grams.

-
4. fresh, firm, clean.
 5. free of abnormal external moisture.
 6. clean, free from mud, dirt and chemical sprays.
 7. free from disease and rots.
 8. free from pest damage.
 9. sufficiently developed, without flesh being fibrous or woody and without over development of seeds.
 10. free from all forms of mechanical damage such as squeezing, scratches, digs, cuts etc.

Class II

This class comprises melongenes which do not qualify for inclusion in Class I, but satisfy the minimum requirements specified in Class I. Provided they retain their essential characteristics of quality and presentation, they may show the following defects.

1. slight defects of shape
2. slight defects of colouring
3. slight sun-scorch provided it does not cover more than 4 cm²
4. slightly dry superficial defects provided they do not cover more than 4 cm²

Class III

This class comprises melongenes which do not qualify for inclusion in the higher classes but satisfy the requirements for Class II. However they may

1. be slightly fibrous
2. show considerable seed development
3. show sun-scorch provided it does not cover more than 6 cm²
4. show healed superficial defects provided that they do not cover more than 6 cm²

Tolerances

In order to allow for variations incident to proper grading and handling, other than for size, not more than 10 percent, by count, in any lot shall be permitted for melongenes which fail to meet the requirements of the grade, including therein not more than one percent for decay.

6.0 PACKINGHOUSE OPERATIONS

6.1 Washing

Melongenes harvested on a rainy day can affect repeat sales since mud and dust can adhere on the surface to cause poor presentation (Plate 9) in addition to the spread of decay organisms. Washing melongenes with water and then allowing to air dry will minimise these problems.



Plate 9 - Melongenes displayed for sale with dirt adhered on skin due to harvesting on rainy day.

6.2 Sorting

Sorting of melongenes is generally done on the ground (in the farm) or on a table in a shed. A simple sorting device can meet the needs of farmers to save time and make sorting easier and more enjoyable. Figure 1 is the design of a simple portable sorting table for possible adoption.

The collapsible and portable sorting table has a wooden frame reinforced with metal sheets. It has a synthetic canvas on table top lined with foam on the periphery to minimize damage.

Two main parts of the devise include:

1. a tripod which can be folded freely
2. a table top fashioned like an umbrella to allow folding
The table top is about 1.8 metres in diameter. It measures about

0.92 metres with an inclination of about 10° from the horizontal level allowing the produce to roll down gently to its periphery.

The table has a maximum capacity of 15 kilograms (33 lbs) with the weight distributed uniformly on its side to maintain proper balance. The circumference of the table, allows 3-5 persons to sort at the same time. For small-scale operations this table offer the following advantages:

1. can be made of locally available materials
2. easy to construct
3. cheap so that farmers can make one for their own use
4. can be used for other fruits and vegetables
5. light and collapsible
6. easy to transport and set up

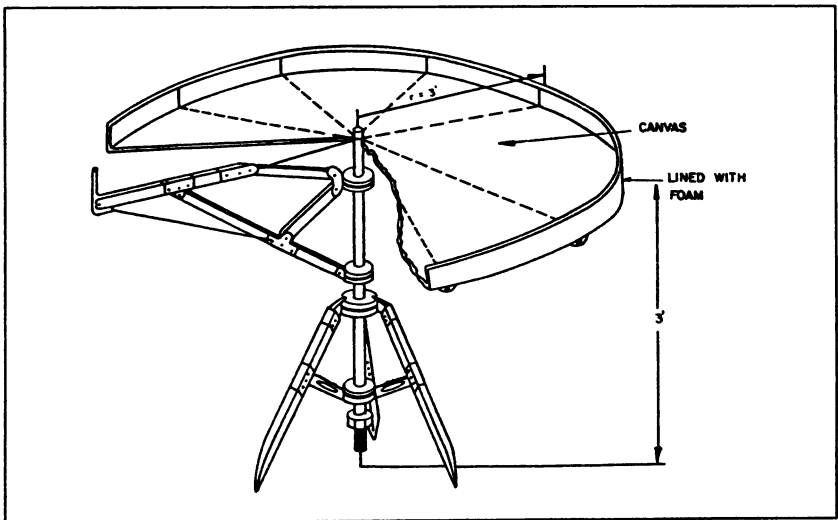


Figure 1 - Portable Sorting Table.

6.3 Packing and Packaging

For domestic market, melongenes may be packed in ventilated wooden boxes, plastic crates, corrugated cardboard boxes or baskets. Melongenes should be packed in rows with cut ends facing each other. Melongenes that are not of uniform size and shape (Plate10) can create problems when packing. The sharpened cut stem and spines on calyx can damage neighbouring ones leading to diseases and water loss.

For export markets, melongenes should be packed in ventilated cardboard cartoons with a maximum capacity of 5 kg. and should not be packed more than one layer deep.



Plate 10 - *Melongene with distorted shapes.*

7.0 TRANSPORTATION

Optimum quality of melongenes can be maintained if transported from field to consumer at refrigerated temperatures. Due to the high costs involved particularly so in the domestic markets, other factors must be considered in the transport function of this crop.

Protecting melongenes from the direct rays of the sun and packing in light coloured containers that are well ventilated and which allows for adequate ventilation can be helpful. Transporting during the coolest period of the day with a damp light coloured cover over packed containers will also prove beneficial.

The type of transportation will also affect the way melongenes should be loaded. Loads which are refrigerated e.g., those destined for supermarkets or export will have to be stacked in such a way that the cool air can circulate around the containers.

During transportation shocks and vibrations transmitted from the road and vehicle to produce can be lessened by:

1. Using vehicles with the best possible suspension system.
2. Educating drivers about road conditions and speeds.
3. Having uniform size of produce containers that allows for proper stacking.

8.0 STORAGE

Melongene selected for storage must be clean, mature, disease-free and without skin blemishes. Melongenes that are damaged or infected will decay faster and so act as a source of infection and shorten the shelf-life of the other melongenes. The relative humidity needs to be kept to about 85-90% to avoid excessive water loss, but should not rise above this level because of the risk of decay. However, melongenes stored at low humidity as experienced under ambient conditions e.g. 28-30°C and 70-75% r.h. can cause shrivelling, drying up of calyx, softening etc. (Plate 11).

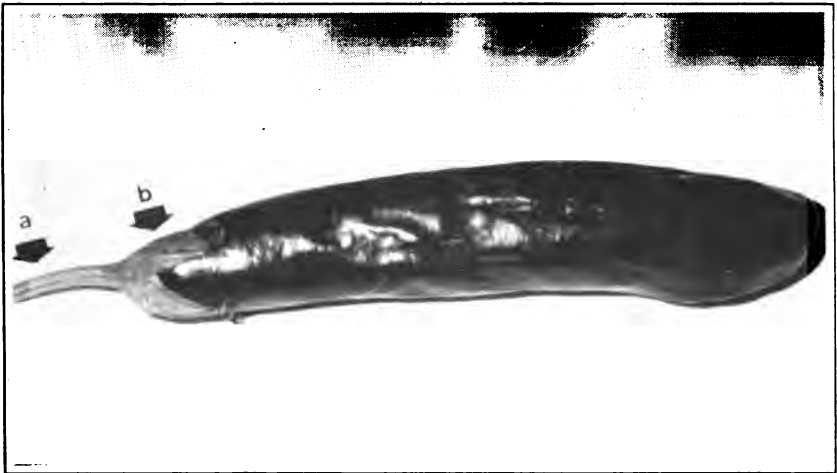


Plate 11 - Appearance of melongene with a 4% fresh weight loss.
Note shrivelling and softening. a - STEM; b - CALYX

Melongenes must not be stored together with other ripening fruits e.g. mangoes, the latter gives off ethylene which can increase ageing and decrease shelf-life. Also if stored together with produce with pungent odours e.g. onions this can affect flavour and eating quality.

Keep storage room free from any decaying fruits and vegetables, because moulds and bacteria can spread to other produce. Thoroughly wash and clean storage rooms between storage periods.

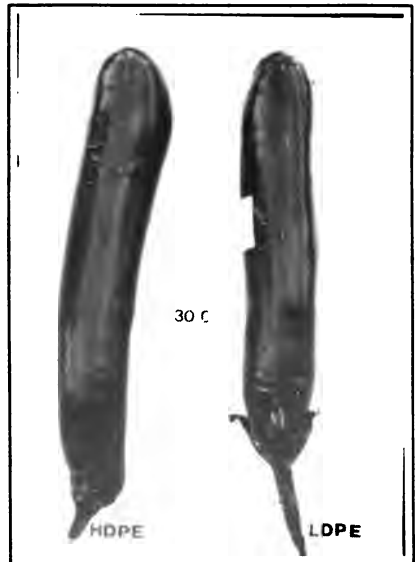
Melongenes have a short shelf-life of about 2-4 days under ambient conditions, after which visible changes in quality such as shrivelling, softening etc. become obvious (Plate 11). Shelf-life of melongenes can be extended up to 15 days if refrigerated at 7°C or 14°C. The quality being best at 7°C when compared to those at 14°C or 30°C (Plate 12). However storage below 7°C results in chilling injury. Recent studies by the author have shown where melongenes sealed-packaged in low density polyethylene (LDPE) and high density polyethylene bags (HDPE) drastically reduced weight loss and consequently resulted in a superior quality (Plate 13) when kept for the same 15 days at 7°C than those unsealed as shown in Plate 12. The modified atmosphere as well as the saturated micro-environment created within the polyethylene bags are mainly responsible for the differences in quality mentioned above. In the absence of refrigeration i.e. if melongenes are packaged and kept at higher temperatures e.g. 28-30°C, the result is faster rotting particularly at the stem end (Plate 14). At 28-30°C within the enclosed packages, the relative humidity often becomes too high, making conditions favourable for growth of micro organisms and development of decay.



Plate 12 - Quality of melongenes after 15 days at 7°, 14° and 30°C.



Plate 13 - Quality of melongene packed in high density polyethylene (HDPE) and low density polyethylene (LDPE) packages after 15 days at 7°C.



**Plate 14 - Decay in melongenes when stored in polyethylene bags at ambient temperature
HDPE — High Density Polyethylene LDPE -- Low Density Polyethylene**

9.0 STORAGE PROBLEMS

Problems associated with melongenes can be classified as post-harvest disorders or disease problems.

9.1 Disorders

9.1.0 Chilling Injury

This is a disorder of melongenes caused by exposure to temperatures below 7°C but not below 0°C. Symptoms of chilling injury include:

1. pitting (sunken spots, in Plate 15)
2. stem and calyx discolouration (brownish black)
3. poor flavour development
4. seed discolouration (darkish brown)
5. increase susceptibility to decay



Plate 15 - Melongene fruit showing multiple infections
1. Bacterial soft rot caused by *Erwinia* 2. Fungal infection caused by *Fusarium solani*
3. Pitting due to chilling injury.

9.1.1 Water Loss

Melongene lose water rapidly. Visible signs of water loss become apparent after a 4% fresh weight loss (Plate 11). Proper precooling prior to storage can help reduce water loss.

Prepackaging in polyethylene films at refrigerated temperatures (Plate 13) is advantageous in reducing water and shrivelling.

9.2 Diseases

9.2.0. Bacterial Soft Rot

Plate 15 shows the melongene at arrow 1 infected by a bacteria *Erwinia* Species. Note the moistened nature of the calyx and the spread to underlying tissues. The bacteria may enter through any puncture or wound of the calyx and grow very rapidly during warm rainy weather.

Very careful handling and proper temperature management during storage can reduce the incidence of this disease.

9.2.1. Fungal Infection

The white fungal mass on the skin surface pointed out at arrow 2 on Plate 15 is caused by *Fusarium solani*. Proper cultural practices, careful handling of produce and rapid cooling can minimise this disease.



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