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Postharvest Handling Technical Bulletin

PINEAPPLE

Postharvest Care and Market Preparation



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POSTHARVEST HANDLING TECHNICAL SERIES

PINEAPPLE

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Ministry of Fisheries, Crops and Livestock
New Guyana Marketing Corporation
National Agricultural Research Institute

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Preface

This publication is part of a series of technical bulletins that seeks to provide specific recommendations for improvements in postharvesting and market preparation for selected non-traditional agricultural products. The intended audience for this series is primarily extension agents.

Initial market assessments in current export markets and visits with producers and exporters in Guyana have shown the quality of fresh produce currently exported is uneven and in some instances very poor. Stages all along the export chain from harvest and pre-harvest to transportation and final export are all in need of improvement. Pre-harvest practices, sanitation at the packinghouse, packaging, bacterial and fungal problems, and transportation were all identified as areas where improvement could benefit the quality and increase the shelf life of Guyana's fresh produce exports. The technical bulletins address these issues specific to each product. Harvesting techniques and crop maturity indices are provided. Preparation for market, including cleaning, sorting, packing and transportation are covered. The bulletins address and recommend specific storage conditions, covering temperature and humidity controls. Finally the bulletins address postharvest diseases and insect damage.

The undertaking of these technical bulletins is a joint effort of the Ministry of Fisheries, Crops and Livestock, the New Guyana Marketing Corporation (NGMC) and the National Agricultural Research Institute (NARI) to improve quality, increase production and promote exports. As a team, the three agencies are working on the problems, limitations, and constraints identified in the initial reconnaissance surveys, from production and postharvest handling problems, to packaging and transportation, to final market.

Introduction

The pineapple (*Ananas comosus*) is one of the most popular fruits in Guyana. It is available year round in the domestic market and significant volumes are also exported to Barbados. The principal production areas are in Regions 3 and 4. The leading cultivar grown is 'Montserrat'. Lesser quantities of the 'Sugar Loaf', 'Smooth Cayenne', and 'Tiger Head' cultivars are also produced.



Figure 1. Mixture of Montserrat pineapple biotypes.

Fruit of the 'Montserrat' cultivar can be sub-divided into two distinct biotypes based on fruit size and shape and length of the crown. One biotype has a conical shaped fruit with a shorter crown. The other biotype has a cylindrical fruit shape with a longer crown. Both biotypes have a relatively tough skin, small pointed fruitlets (eyes), and a relatively long postharvest life (Figure 1). The internal flesh color of both biotypes is pale yellow and fruit weight ranges between 1.5 to 3.0 kg.

'Sugar Loaf' pineapples are the sweetest in flavor among the cultivars produced in Guyana. However, the skin is very delicate and the fruit has a short shelf life. The fruit is oblong in shape and averages about 2 kg in weight. Skin color is dark green when mature and changes to bright yellow as the fruit ripens. It is highly aromatic when fully ripe.

'Smooth Cayenne' fruit is cylindrical in shape, with green skin color and flat, broad eyes. The flesh is pale yellow in color with high acidity, acceptable flavor, and is susceptible to translucency. It is the leading export cultivar produced worldwide, and is suitable for both fresh market and processing (canning or juice). Fruit weight averages around 2 kg.

'Tiger Head' is a minimally grown cultivar, mostly produced in the Amerindian settlements in the Hinterland areas. Fruit shape is long and rounded with an average size of 2.5 kg. The texture is somewhat fibrous and coarse, and the flavor is sweet.

Harvesting

Pineapple fruit should be harvested when firm and mature. Pineapples do not improve in eating quality after harvest. Sugar content does not increase after harvest. Therefore, the fruit must be picked at the optimum maturity and ripeness stage to suit the intended market.

Domestically marketed fruits should be harvested close to full ripeness, which in the case of the Montserrat cultivar is at the one-half yellow external surface color. Fruit is near its maximum mass at this color stage if still on the plant. Fruit intended for the export market should be picked slightly sooner, at the quarter-yellow color stage. It will also be necessary to expeditiously move the product from the field to the packing area to the



Figure 2. Over-mature pineapple (full-yellow stage) not suited for export.

airport as soon as possible and use a strong package coupled with air conditioned temperature storage. Fruits picked mature but prior to full ripeness (i.e. less than one-quarter yellow) will be firmer and better able to tolerate long distance transport. However, they will have a less desirable flavor. Nevertheless, without refrigeration or rapid transport to market, it will be necessary to sacrifice some flavor for adequate firmness in order to have the potential to export the fruit. Pineapples harvested when immature will not ripen and will have a low sugar content and poor flavor. On the other hand, fruit harvested over-mature will get soft and bruise easily during transport and will have a very short market life (Figure 2).

The two components of quality that may change after harvest are external color and texture of the flesh. Pineapple fruit typically changes from a green to yellow-orange color during storage. In addition, the texture of the flesh softens with time.

The crown (whorl of leaves attached to the apical end of the fruit) should be left intact and protected from damage. Consumers associate crown freshness and condition with fruit quality. The practice of crown removal by some vendors in the domestic market is not recommended. This leads to microbial decay of the wounded area and a rapid rate of deterioration. In addition, the fruit appearance is less appealing without the crown.

Crop Maturity Indices

There is no single foolproof indicator of pineapple fruit maturity. However, several external and internal fruit characteristics can be used in combination as indices to determine harvest maturity. The external indices include fruit surface color (in most cultivars), the extent of fruitlet (eye) flatness, and fruit size. The internal indices include % soluble solids (i.e. sugar content) and appearance.

The amount of fruit surface yellowing may be used as a guide for determining when to harvest in certain cultivars. Generally, the more yellow the surface area (less chlorophyll), the more mature and ripe the fruit. The natural progression of surface color change during

pineapple fruit maturation is from green to yellow to reddish-brown. The Montserrat cultivar is considered ripe and at its best eating quality when the fruit surface color is at the one-quarter to one-half yellow stage. This is when the balance between sugar content and acidity is optimal for good flavor. If the fruit is allowed to remain on the plant until the full yellow stage it will have a flatter, less desirable flavor due to excess sugar content coupled with decreased acidity. The fruit will also be more susceptible to bruise damage at the full yellow stage. At very advanced stages of over-maturity, the surface color of the fruit changes to reddish-brown. Once the fruit has been harvested, the change in surface color and amount of yellowing should not be used as an indicator of fruit ripeness (i.e. sweetness), since postharvest color changes are not correlated with eating quality.

The pineapple is a compound fruit comprised of numerous individual fruitlets. The fruitlets mature progressively from the bottom part of the fruit to the top. As the fruitlets mature, they become flatter. The extent of fruitlet flatness is usually a good indicator of overall fruit maturity. The bottom fruitlets are much flatter (and riper) than the top ones. A Montserrat pineapple is typically mature and ready for harvest when the lower one-quarter to one-half of the fruitlets become flat.

Fruit which is ready for harvest should reach the appropriate size indicative of the cultivar. This is largely based on previous growing experience. However, individual fruit size by itself is not a reliable index of harvest maturity. It should be used in addition to surface color and fruitlet flatness.

Fruit maturity is highly correlated with soluble solids content. Pineapple fruit should have a minimum of 12% soluble solids near the base and 10% near the top. This is determined by taking two cross sections of the fruit; one at the point of its largest diameter near the base and another in the upper third portion of the fruit, and squeezing a few drops of juice from each cross section onto the prism of a hand-held refractometer. However, this is a destructive test of harvest maturity. It is used mostly in large-scale operations where sacrificing fruit of different sizes is acceptable in order to determine the correlation between fruit size and maturity.

The internal appearance of the flesh is also indicative of fruit maturity. Random samples of fruit should be sliced horizontally at the point of the largest diameter. Immature Montserrat fruit has a white flesh color, while mature or ripe fruit has a yellowish-white flesh. The flesh also becomes slightly translucent in appearance at maturity (Figure 3). Fruits are over-mature when more than half of the cross-sectional area of the fruit is translucent. The conical-shaped biotype of Montserrat develops flesh translucency sooner than the cylindrical biotype.



Figure 3. A slightly translucent internal fruit is indicative of maturity.

Harvest Methods

Pineapples are harvested by hand, with the pickers being instructed as to the stage of maturity required. The fruit should be broken off the stalk with a downward motion, or cut with a knife slightly below the base of the fruit. A large canvas picking sack which is strapped over the shoulders is commonly used as a harvest-aid in many parts of the world (Figure 4). Up to 6 fruits can be put in the sack, which is able to be opened from the bottom to allow the fruit to be transferred to a larger field container or padded wagon. The fruit may also be harvested in wooden or plastic field crates.



Figure 4. Canvas sack commonly used for harvesting pineapple.

Preliminary grading of the fruit according to size, condition, and maturity should be done at this time. The fruit should then be transported as soon as possible to a shaded collection area or packing facility. The commonly available plastic or nylon sacks should not be used for transport, as they will cause significant amounts of mechanical damage to the fruit. Avoid exposing the fruit to the direct sun in order to prevent softening and possible sunburn (Figure 5). Fruit stacked in piles at collection sites should be transported as soon as possible to shaded packing facilities. Fruit bruising is a major problem during harvesting and packing. A fruit drop of 30 cm can result in serious damage, which typically appears as discolored, slightly straw-colored flesh.



Figure 5. Harvested fruit should be protected against sunburn.

Preparation for Market

Cleaning

Pineapple fruits are quite perishable and should ideally be packed for market within a day of harvest. The initial step in preparation for market involves cleaning of the outside of the fruit. For the domestic market, this generally involves trimming of the stem at the base of the fruit to a length of 1-2 cm, removing any damaged or unsightly leaves in the crown, and a gentle dry brushing of the fruit surface to remove dirt and dust. A similar protocol should be followed for the export market, with more emphasis placed on fruit uniformity and quality. Depending on the export market requirements, all fruits which are undersized, oversized, over-ripe, under-ripe, damaged, bruised, or show fungal or insect damage should be discarded.

The Barbados market requires a specific protocol to be adhered to. The stem must be trimmed very close to the base (Figure 6) and the crown has to be cut back to a length of ≤ 10 cm. Then the fruit has to be washed in a soap solution and thoroughly scrubbed on the outside with a brush to remove all live insects (Figure 7). The wash water should be properly chlorinated (150 ppm free chlorine) and maintained at a pH of between 6.5 to 7.0. In addition, an approved postharvest fungicide should be added to the wash solution to reduce decay. Bayleton and benomyl are two postharvest fungicides commonly used in other countries. After washing, the fruit must be dried and inspected by a trained and certified Guyanese Ministry of Agriculture (Plant Health Unit) inspector. Fruit approved for export by the inspector can then be packed.



Figure 6. Trimming of the base of pineapple fruit destined for Barbados.



Figure 7. Washing and brush scrubbing of pineapple fruit to remove mealybugs.

Waxing

For maximum potential shelf life, pineapple fruit should be waxed after cleaning and drying. Several types of food-grade waxes are appropriate for pineapples, and they can be applied by dipping or spraying. The most commonly used waxes for pineapples are mixtures of carnauba and paraffin or polyethylene and paraffin. The type of wax chosen must be approved by the importing country, if the market destination is for export. The wax should be applied only to the fruit surface and not the crown, as many waxes cause injury to the crown. Beneficial effects of waxing include a reduction in fruit internal browning, less moisture loss, and a shinier external appearance.

Sorting

Regardless of the market destination, the fruit should be sorted according to size, shape, firmness, external color, insect damage, and decay. Visibly damaged fruit should be rejected. Different markets have different quality requirements and the fruit should be graded to conform to the individual market standards. However, there are certain minimal requirements for pineapple fruit intended for any market. The fruit should:

- be clean and free of dirt or stains
- be mature and firm
- be well shaped and have fully developed eyes (fruitlets)
- be free of punctures, wounds, and cuts
- be free of sunburn, insect damage and decay
- have a well cured butt
- have a single crown

In addition to the above general requirements, the Guyanese market standards (Guyana National Bureau of Standards) stipulate that:

- 80% of the fruit surface should exhibit the color typical of the variety at maturity
- the stem should be trimmed near the base of the fruit, with 4 bracts remaining
- large-sized fruit is 2.1 kg, medium-sized fruit ranges from 1.2-2.0 kg, and small-sized fruit ranges from 0.7-1.1 kg
- packages should contain 6 or 9 fruits, which can be oriented horizontally or vertically

Pineapple fruit destined for Barbados require the crown be trimmed back to a length of ≤ 10 cm. On the other hand, fruit destined for U.S. and Canadian markets must have an intact crown > 10 cm in length. No more than 10% of the crown leaves should be discolored. Mechanical damage must be confined to $< 5\%$ of the fruit surface area and any bruise must not exceed 3.75 cm in diameter or be deeper than 0.6 cm.

Packing

All fruit packed in the same carton or container should be uniform in size, shape, and external color. Immature or over mature fruit should not be packed for export (Figure 8).

It is important that the carton be properly ventilated and be of sufficient strength to withstand the rigors of distribution without collapsing. Weak cartons do not have sufficient physical strength to be stacked and result in major



Figure 8. Uniform sized and shaped fruit destined for U.S. market.

losses of the fruit upon arrival in the destination market. Inferior packaging is a constraint facing Guyanese exporters.

A carton with at least 275 lb/in² bursting strength should be used to avoid damage to the product during transport and handling. A commonly used package in the international trade of pineapples is a full-telescopic two-piece corrugated fiberboard carton (Figure 9). Top and bottom ventilation, in addition to side vents are required, particularly where sea-shipments are used. Typical carton inside dimensions are 30.5 cm wide x 45 cm long x 31 cm deep (12 in x 17.7 in x 12.2 in).



Figure 9. Typical corrugated fiberboard carton used for exporting pineapples.

The preferred method of packing is to place the fruit vertically on the base, and then to place dividers between the fruits to prevent rubbing and movement. With some cartons, this is not possible and fruit are laid horizontally in alternating directions; where two layers of fruit are packed, a divider is required between the layers. Another commonly used export carton for pineapples is a single-layer corrugated fiberboard carton (Figure 10).

The Barbados market requires the fruit be packed in corrugated containers. The fruit may be oriented vertically or horizontally inside the carton. Typically, about 40 ±5 lb. of fruit are put in each carton. It is important the carton be properly ventilated and be of sufficient strength to withstand the rigors of distribution without collapsing. Weak cartons do not have sufficient physical strength to be stacked and result in major losses of the fruit upon arrival in the destination market. Inferior packaging is a constraint facing Guyanese exporters. A carton with at least 275 lb/in² bursting strength should be used to avoid damage to the product during transport and handling. The size of the carton varies according to market destination.



Figure 10. Single-layer corrugated fiberboard carton used for exporting pineapples.

The U.S. and Canadian markets prefer either a single layer carton containing 6 to 12 fruits or a double layer carton containing 12 to 20 fruits. The approximate weight associated with the different count sizes is:

- 6 count - 1.75 kg fruit (3.8 lb)
- 12 count - 1.25 kg fruit (2.7 lb)
- 20 count - 0.75 kg fruit (1.6 lb)

Export packages should be labelled with the name and address of the exporter, country of origin, size (grade) of fruit, variety, and net weight of product.

Storage Conditions

Temperature

For maximum postharvest life, pineapple fruit should be cooled to 8°C (47°F) as soon as possible after harvest and maintained at this temperature during transport to market. At this temperature, pineapples harvested at the quarter-yellow stage have a shelf life of approximately 3 weeks. Storage at higher temperatures will result in an abbreviated shelf life, to as short as only a few days at ambient temperature (i.e. 30-32°C). Fruits that are quarter yellow at harvest gain about four additional days of shelf life for every 6°C decrease in storage temperature from 32° to 8°C. On the other hand, pineapple fruits are subject to low temperature breakdown, also known as chilling injury, and should not be stored below 8°C. Sensitivity to chilling injury is related to the ripeness stage of the fruit, with mature green fruit being more susceptible. Internal tissue darkening and postharvest decay are typical symptoms of chilling injury.

Pineapples harvested at more advanced stages of ripeness will have an abbreviated market life. For example, fruit harvested at the half-yellow color stage will have about 10 days of storage life at 8°C followed by an additional week of market life.

Relative Humidity

Pineapple fruits are susceptible to wilting and shrivelling in low relative humidity (RH) storage environments. Most of the weight loss occurs through the leaves of the crown. The rate of transpiration and water loss from the fruit becomes increasingly greater with decreasing RH. Ideally, pineapples should be held at 90 to 95% RH.

Transport

Fruit should be transported carefully to market in order to minimize bruise damage and subsequent postharvest decay. Use of strong protective packaging will help to minimize bruise damage. Proper loading and stacking of the cartons in the bed of the transport vehicle is essential to protect the product. Sufficient air circulation through the sides of the cartons is necessary to avoid product re-warming during transport. The pineapple cartons should be covered and never exposed to direct sunlight during transport. This will accelerate the rate of ripening and softening of the fruit, in addition to possible sunburn damage. In the absence of refrigeration, the fruit should be transported during the cooler part of the day.

Principal Postharvest Diseases

Pineapples are susceptible to a number of postharvest diseases. Decay is significantly higher in mechanically injured fruit, when poor sanitation practices are followed, or if postharvest cooling is not provided. The fused nature of the fruitlets means that the flesh of the fruit is not sterile and contains yeasts and bacteria. The most common ones are black rot, fruitlet core rot, and yeasty fermentation.

Black Rot

Black rot, caused by the fungus *Thielaviopsis paradoxa*, is typically the most common and severe postharvest disease of pineapple. It is also referred to as stem end rot, water blister, or soft rot and is characterized by a soft watery rot of the flesh. The severity of this disease depends on the amount of fruit bruising or wounding incurred during harvest and packing, the level of inoculum on the fruit, and the postharvest temperature. There is also a strong correlation between rainfall duration prior to harvest and postharvest incidence of this disease. Black rot does not occur in the field unless the fruit is overripe or injured. Susceptibility also varies with cultivar, with Montserrat being less affected than Smooth Cayenne.

Black rot usually starts at the point of detachment of the fruit (stem end), although it can readily infect bruised or other damaged areas of the fruit. Infection occurs 8 to 12 hours

after wounding and symptoms begin as a soft, watery rot which later darkens due to growth of the dark-colored fungal mycelium and spores (Figure 11). Fungal growth is rapid at temperatures between 21-32°C.

Control of black rot is achieved by minimizing mechanical injury to the fruit coupled with appropriate postharvest sanitation (150 ppm chlorine wash plus fungicide). The most effective postharvest fungicides for controlling black rot are thiabendazole, benomyl, and captan. For effective control, the fruit must be dipped in the fungicide within 6 hours after harvest. Storage of the fruit at 7°C is also necessary to inhibit growth of the fungus.

Fruitlet Core Rot

Fruitlet core rot is a postharvest fungal disease-yeast-mite complex of pineapples caused by the fungi *Penicillium funiculosum*, *Fusarium moniliforme* var. *subglutinans*, the round yeast *Candida guilliermondi*, the fruit mite *Steneotarsonemus*, and the red mite *Dolichotetranychus floridanus*. This disease complex is also called black spot or fruitlet brown rot. Symptoms appear as brown to black colored areas in the center part of individual fruitlets (Figure 12). This disease is more serious in low-acid cultivars. The principal means of reducing the incidence of fruitlet core rot is by spraying the crop with an acaricide to control the mites which spread the disease.



Figure 11. Black rot symptoms on pineapple fruit.



Figure 12. Symptoms of fruitlet core rot on pineapple.

Yeasty Fermentation

Pineapple fruits are not sterile inside and contain many non-growing, but viable yeasts and bacteria. In damaged, overripe, and inter-fruitlet cracked fruit, existing yeasts may start to grow or new yeasts may invade. The yeast *Saccharomyces* is most often responsible for fermentation. Symptoms include fermentation, with bubbles of gas and juice escaping through cracks in the skin. The skin eventually turns brown and leathery and the internal flesh becomes spongy with a bright yellow flesh (Figure 13).



Figure 13. Pineapple fruit affected by yeasty fermentation.

Postharvest Insects

Mealybugs are typically the worst postharvest insect problems of pineapples. They invade the fruit prior to harvest and hide in crevices between fruitlets, underneath the crown leaves, or inside the whorl of the crown. They can be significantly reduced in population by preharvest insecticide sprays and ant control. After harvest, they need to be removed by brushing the fruit.

Postharvest Disorders

Sunburn

Localized sunburn of the fruit surface can be a problem on fruit left exposed to full sun after harvest. The affected areas of the fruit surface show a bleached yellow-white skin, with damage to the underlying flesh. The damaged tissue is more susceptible to postharvest decay. Sunburn can be avoided by putting the fruit in a shaded area after harvest.

Chilling Injury

Chilling injury (CI) occurs in pineapple fruit stored below 7°C. External symptoms of CI include wilting and discoloration of the crown leaves, failure of green-shelled fruit to yellow, browning and dulling of yellow fruit, surface pitting of the fruitlets which eventually coalesce into larger sunken lesions, and postharvest decay. Internal symptoms of CI include flesh browning or darkening, tissue softening, and off-flavor development. CI becomes more severe with decreasing storage temperatures and increasing lengths of exposure to chilling temperatures. Also, immature fruits are more susceptible to CI than mature fruit. (Full-green color stage pineapple may suffer CI at 10°C). Although the tissue damage from CI in quarter-yellow color stage fruit only occurs at temperatures below 7°C, development of the symptoms occurs within several days at ambient temperature following

removal from cold storage. Postharvest waxing of the fruit minimizes CI symptom development.

Internal Browning

Internal browning is a common postharvest physiological disorder affecting pineapples in Guyana. It is more pronounced in those cultivars like Smooth Cayenne that have a low ascorbic acid content. In addition, it is more severe in those fruits exposed to cool night temperatures followed by high day temperatures prior to harvest. Storage of the fruit below 7°C (45°F) also accentuates internal browning.

Symptoms begin as small grayish translucent areas at the base of the fruit near the core. These areas eventually darken and in severe cases the entire internal flesh turns brown to black in color.

Control of internal darkening may be obtained by waxing the fruit.

Flesh Translucency

Flesh translucency is a physiological disorder in which the internal flesh becomes shiny and translucent in appearance. It is more common in less mature harvested fruit. Translucency begins before harvest and continues during storage. It is generally more common in fruits with small crowns. Waxing can reduce the rate of translucency development after harvest. Translucent fruits are more susceptible to mechanical injury, which leads to intracellular sap leakage and loss of marketable fruit.

ANNEX I

PUBLICATIONS IN THE POSTHARVEST HANDLING TECHNICAL BULLETIN SERIES

- PH Bulletin No. 1 Pineapple: Postharvest Care and Market Preparation, November 2002.
- PH Bulletin No. 2 Plantain: Postharvest Care and Market Preparation, November 2002.
- PH Bulletin No. 3 Mango: Postharvest Care and Market Preparation, November 2002.
- PH Bulletin No. 4 Bunch Covers for Improving Plantain and Banana Peel Quality, November 2002.

PLANNED PUBLICATIONS - 2003

- Cassava: Postharvest Care and Market Preparation.
- Eggplant (Boulanger): Postharvest Care and Market Preparation.
- Papaya: Postharvest Care and Market Preparation.
- Lime: Postharvest Care and Market Preparation.
- Sweet Potato: Postharvest Care and Market Preparation.
- Watermelon: Postharvest Care and Market Preparation.
- Peppers: Postharvest Care and Market Preparation.
- Yam: Postharvest Care and Market Preparation.
- Orange: Postharvest Care and Market Preparation.
- Ginger: Postharvest Care and Market Preparation.
- Pumpkin: Postharvest Care and Market Preparation.

Harvest Maturity Indices

There are several measures of pineapple maturity: surface colour, fruitlet flatness and internal appearance.

Fruit Surface Colour

Pineapples change from green to yellow to reddish-brown as they mature. Pineapples harvested in the full green colour stage are often immature with a low sugar content and poor flavour. Pineapples are considered ripe and at their best eating quality when the fruit surface colour is the one-quarter to one-half yellow. If the fruit is not harvested until the full-yellow stage it will have a flatter, less desirable taste due to excess sugar content and decreased acidity. The fruit will also bruise easily and is more vulnerable to damage. Pineapples are over-mature when the surface colour of the fruit changes to reddish-brown.

Pineapples for the domestic markets should be harvested close to full ripeness, when external surface colour is one-half yellow. Fruit intended for the export market should be picked slightly sooner, at the quarter-yellow colour stage.

Fruitlet Flatness

The pineapple has numerous individual fruitlets, which mature from the bottom part of the fruit to the top. As the fruitlets mature, they become flatter. A pineapple is typically mature and ready for harvest when the lower one-quarter to one-half of the fruitlets are flat.

Internal Appearance

Random samples of fruit should be sliced horizontally at the point of the largest width. Immature pineapple fruit have a white flesh colour, and are slightly clear in appearance while mature or ripe fruit have a yellowish-white flesh. Fruit are over-mature when more than half of the cross sectional area of the fruit is transparent.

Harvest Methods

Pineapple fruit should be broken off the stalk with a downward motion, or cut with a knife slightly below the base of the fruit. A large canvas picking sack carried over the shoulders is commonly used as a harvest-aid. The sack can be opened from the bottom to allow the fruit to be transferred to another field container or wagon. The harvested fruit may also be placed in wooden or plastic field

crates. The crown should be left intact and protected from damage. Removal of the crown increases the risk of disease and decay and is not recommended. ¹

The fruit should be moved as soon as possible to a shaded collection area or packing facility. Fruit left in the direct sun will sunburn and turn soft. The damaged tissue is more susceptible to postharvest decay.

Preparation for Market

Cleaning

The first step in market preparation is cleaning of the outside of the fruit. Trim off the stem at the base of the fruit to a length of 1 cm to 2 cm (less than an 1 in). Remove any damaged or unsightly leaves in the crown. Gently dry brush the fruit surface to remove dirt and dust.



Pineapples exported to Barbados must be washed and brushed in order to comply with Bajan phytosanitary requirements regarding pink mealybug avoidance. The wash water should be sanitized with 150 ppm hypochlorous acid (household bleach) maintained at a pH of 6.5. This is equal to 2 oz of household bleach (such as Marvex) per 5 gallons of water, or .3 liters of bleach per 100 liters of water.

Waxing

Wax can be applied to the fruit after cleaning to extend shelf life. The wax should be applied only to the fruit surface and not the crown. Benefits include less internal browning and moisture loss and a shinier external appearance. The most commonly used waxes for pineapples are mixtures of carnauba and paraffin or polyethylene and paraffin.

¹ Under the current protocol with Barbados and Antigua, the crown must be removed prior to shipment. This is done at the packing house during sorting and before cleaning. In addition, the pineapples can receive a hot bath treatment that will help prevent black rot.

Sorting

Grading of the fruit according to size, condition, and maturity should be done at harvest. Pineapples should be sorted according to size, shape, and decay. Visibly damaged fruit should be removed. The fruit should be clean, mature, firm, well-shaped, and have fully developed eyes (fruitlets). In addition, the fruit should be free of wounds, cuts, sunburn, insect damage and decay. The fruit should have a cleanly trimmed stem end with 4 or less bracts remaining and a single crown. Domestically marketed fruit should be separated into 3 different sizes: large, equal to or less than 2.1 kg (4.6 lb); medium, 1.2 kg to 2.0 kg (2.6 lb to 4.4 lb); and small, 0.7 kg to 1.1 kg (1.5 lb to 2.4 lb).

Packing

Fruit packed in the same carton should be the same in size, shape, and external colour. Immature or over mature fruit should not be packed for export. The cartons must be properly ventilated and strong enough to withstand the hardships of shipping without breaking down. Weak cartons result in major losses of the fruit upon arrival in the destination market.

A commonly used package in the international trade of pineapples is the full-telescopic two-piece corrugated fiberboard carton. Another commonly used export carton for pineapples is the single-layer corrugated fiberboard carton. The ideal method of packing the single-layer carton is to place the fruit horizontally inside the box in alternating directions. Thin cardboard dividers should be put between the fruits and between the layers to prevent rubbing.

Fruit are normally packed to a net weight of 10 kg to 15 kg (22 lb to 33 lb) depending on the carton and the market. High value small pineapples may be shipped in 6 kg (13 lb) boxes, whereas the large fruit in some cases may be packed up to 20 kg (45 lb).



Temperature Control

Pineapple fruit should be stored at 8°C (47°F) for maximum postharvest life. At this temperature, pineapples harvested at the quarter-yellow stage have a shelf life of approximately 3 weeks. Storage at higher temperatures will result in an abbreviated shelf life

to as short as only a few days at ambient temperature. Fruit at the quarter-yellow maturity stage at harvest will gain about four additional days of shelf life for every 6°C decrease in storage temperature from 32°C to 8°C (89.6°F to 47°F). Pineapples harvested at more advanced stages of ripeness will have a shorter market life. Fruit harvested at the half-yellow colour stage will have about 10 days of storage life at 8°C followed by an additional week of shelf life.

Pineapple fruit are subject to chilling injury (CI) and should not be stored below 7°C (44.6°F). External symptoms of CI include surface pitting, discolouration, failure of green-coloured fruit to turn yellow, and postharvest decay. Internal symptoms of CI include flesh darkening, tissue softening, and off-flavour development. CI becomes more severe with decreasing storage temperatures and increasing lengths of exposure. Mature green fruit are more at risk to CI. Pineapples should be kept at 90% to 95% relative humidity.

Postharvest Disease

Pineapples are prone to a number of postharvest diseases. Decay can be controlled by good pre-harvest sanitation, careful harvesting and handling practices to minimize injury to the fruit, properly sanitized wash water, and storing the fruit at 8°C. A postharvest fungicide treatment (500 ppm benomyl or 1000 ppm thiabendazole) is effective in reducing fungal decay of the stem end. Follow manufacturer's instructions for use of fungicides. For effective control, the fruit must be dipped in the fungicide within 6 hours after harvest.



Black Rot

Black rot is the most common and severe postharvest disease of pineapple. It is also referred to as stem end rot, water blister, or soft rot and is characterized by a soft watery rot of the flesh. Black rot usually starts at the stem end. Symptoms begin as a soft, watery rot which later darkens due to growth of the dark-coloured fungus.

Fruitlet Core Rot

This disease is also called black spot or fruitlet brown rot. Symptoms appear as brown to black coloured areas in the center part of individual fruitlets. The principal means of reducing the incidence of fruitlet core rot is by spraying the crop with an acaricide, a specific insecticide to control the mites that spread the disease.



Yeasty Fermentation

Pineapple fruit are not sterile inside and contain many non-growing viable yeasts and bacteria. In damaged, overripe, and inter-fruitlet cracked fruit, existing yeasts may start to grow or new yeasts may invade. Symptoms include fermentation, with bubbles of gas and juice escaping through cracks in the skin. The skin eventually turns brown and leathery and the internal flesh becomes spongy with a bright yellow flesh.

Postharvest Insects

Mealybugs are typically the worst postharvest insect problem of pineapples. They invade the fruit prior to harvest and hide in crevices between fruitlets, underneath the crown leaves, or inside the whorl of the crown. They can be significantly reduced with the use of preharvest insecticide sprays and ant control. After harvest, they need to be removed by brushing the fruit.



Technical bulletins are also available on waxing fruits and vegetables and hot bath treatment. Contact:

New Guyana Marketing Corporation (NGMC)
87 Robb & Alexander Sts., Georgetown, Guyana
Tel: 226-8255, 226-2219

National Agricultural Research Institute (NARI)
Mon Repos, East Coast Demerara, Guyana Tel: 220-2950



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PINEAPPLE

Postharvest Handling and Market Preparation Information Sheet



This information sheet provides a summary of the recommended harvest and postharvest handling practices for pineapple. A more technical and detailed bulletin is available from the New Guyana Marketing Corporation (NGMC) and the National Agricultural Research Institute (NARI).