

## Harvest Maturity Indices

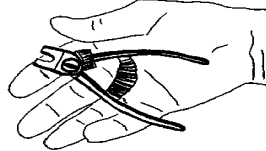
The most common non-destructive method of checking fruit maturity is peel colour. Tangerines are mature and ready for harvest when 50% of the peel surface has turned yellow in colour.

A commonly used method for determining fruit maturity is an assessment of the fruit's juice characteristics. Random samples of fruit of similar size are taken and measured for percent soluble solids (% SS), titratable acidity (TA), and the % SS:TA ratio. In order to reduce inconsistency, the juice sample should be taken from a total of 10 randomly selected fruit.



## Harvest Methods

Tangerine fruit should be carefully harvested by hand using clippers to remove the fruit. The fruit should not be pulled off the tree, as part of the skin tissue will remain attached to the stem, creating a small opening in the peel surface. This is known as 'plugging' and it results in an open wound in the skin for micro-organisms to enter and cause decay. The harvested fruit should be carefully placed into field crates, well-ventilated plastic containers, or small picking bags. Avoid rough harvesting practices which cause bruise damage and fruit decay.



## Preparation for Market

### De-greening

Tangerine fruit produced in Guyana is often mature and of acceptable quality when the rind is still green. However, consumers in export markets associate external skin colour with internal flavour and believe tangerines with a green-coloured peel are not sufficiently sweet. In order to improve external skin colour and meet export market requirements tangerines can be treated with ethylene to de-green the peel.



The general de-greening protocol exposes the green-skinned tangerine fruit to low concentrations of ethylene (usually between 1 to 10 ppm) at 28°C (83°F), 90% to 95% relative humidity for several days.

A liquid ethylene-releasing compound, called ethephon, is also a good de-greening agent. It is applied by dipping the fruit in a tank of clean water at ambient temperature with 500 ppm ethephon for 1 minute.

### Cleaning

Harvested tangerine fruit is generally not clean enough to pack directly from the field. Small scale operations usually dip the fruit in a wash tank, followed by a gentle scrubbing of the fruit surface. It is important to use clean and properly sanitized water with a small amount of detergent. The water should be treated with hypochlorous acid (150 ppm household bleach at a pH of 6.5). This is equal to 2 oz of household bleach (such as Marvex) per 5 gallons of water, or 0.3 liters of bleach per 100 liters of water. The concentration of hypochlorous acid and water pH should be frequently checked and maintained at the recommended levels throughout the cleaning process.

### Grading

Tangerines should be categorized according to size, colour strength and evenness, shape, firmness, and the degree of surface damage. Only fruit that look the same and are free from decay should be packed. Tangerines destined for the export market should have a minimum diameter of 6 cm (2 in). Grading can be done manually in small-scale operations or semi-automatically in larger volume operations.

### Waxing

Tangerine fruit benefit from a postharvest wax application. The simplest ways to make the wax application are as a manual rub or an overhead spray as the fruit are rotating on a bed of brushes made of horsehair. Waxing reduces moisture loss and shriveling of the fruit and extends the market life. Waxing also creates an attractive shine to the peel.

### Packing

Tangerines should be packed in strong, well-ventilated containers. Wooden crates are effective containers for domestic marketing of tangerines. The use of large sacks containing 30 kg (66 lb) or more

of fruit is undesirable since they do not provide enough protection to the fruit against compression bruising.

The ideal containers for export marketing of tangerines are fiberboard cartons or wooden wire-bound crates. Export containers are packed with 12 kg (25 lb) or 18 kg (40 lb) of fruit.



## Temperature Control

Tangerines do not maintain good quality when kept at ambient temperature. The fruit will have a high rate of decay after 2 weeks, and will be nearly all decayed or shriveled after 4 weeks at 24°C (75°F). Tangerine fruit is also at risk to puffiness, in which the peel separates from the pulp at high storage temperatures. The ideal storage temperature for tangerines is 4°C (39°F), and at this temperature the fruit will have a storage life of 4 to 6 weeks. Tangerines are vulnerable to chilling injury (CI), if held below 4°C. Symptoms of CI include pitting and sunken spots on the peel surface, secondary decay, and off-flavour.

## Relative Humidity

Although tangerines have a waxy peel, significant moisture loss can occur after harvest. Water loss and shriveling of the fruit become visible after the fruit has lost 5% of its original weight. In order to minimize postharvest water loss and preserve postharvest quality, tangerines should be stored at their optimum relative humidity (RH) of 90 to 95%. At a RH of less than 70%, the peel will become thin, dry, and shriveled within 3 weeks.

## Principal Postharvest Diseases

Tangerines are vulnerable to a number of different postharvest pathogens. Tangerines must be harvested and handled gently to avoid bruising and skin injury, which greatly increases the rate of decay. During cleaning, the wash water should be sanitized with hypochlorous acid and fungicides added to the wash water give additional protection against many postharvest pathogens. The most effective fungicides are benlate (500 ppm), and thiabendazole or imazalil (1000 ppm). In addition, pads impregnated with the fungistat diphenyl (at the rate of 4.7 gm/23 kg fruit) can be placed in shipping cartons to limit the development of postharvest decay

during transport and distribution to market. To minimize decay, tangerines should be held at 4°C (39°F) and 90% to 95% RH.

#### *Green Mould*

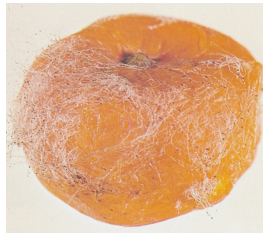
Green mould is typically the worst postharvest disease of tangerines. It attacks injured areas of the peel and first appears as a soft, watery, de-colourized spot on the rind. White fungal growth soon appears on the fruit surface, and after the spot enlarges, olive-green spores are produced in the center part of the spot. Under high RH conditions, the fruit collapses into a soft, decomposing mass. If the storage RH is low, the fruit shrinks to a wrinkled, dry mummy.

#### *Blue Mould*

Blue mould is a common disease of tangerines during long term cool storage. Like green mould, blue mould develops most rapidly at about 24°C (75°F). However, blue mould grows at temperatures too low for green mould (below 6°C or 43°F). It attacks injured areas of the peel and appears as soft, watery, de-colourized spots on the rind. Soon afterwards, a blue mould growth begins, surrounded by a zone of white mycelium. Unlike green mould, blue mould spreads in packed containers and results in nests or pockets of diseased fruit.

#### *Brown Rot*

Brown rot is a serious postharvest disease of tangerines during periods of rainy weather. Symptoms first appear as light brown colourations of the peel. The affected area is firm and leathery. White fungal growth appears on the fruit surface under humid conditions. Infected fruit have a strong, rancid odour.



#### *Rhizopus Rot*

Rhizopus rot infects fruit through wounded areas in the peel. Lesions begin as rapidly enlarging, water-soaked areas located adjacent to wounds or openings in the button area. Normally the infected area is not discoloured, but the spots are soft and somewhat watery. Under high humidity, grayish white masses of mould structures develop over the surfaces of diseased fruit. In packed cartons of tangerines, nests of fungal growth will develop on decayed fruit.

#### *Phomopsis Stem-end Rot*

Stem-end rot is a serious postharvest disease of tangerines grown in humid coastal areas. Decay begins at the stem end of the fruit and spreads evenly down the peel. Eventually the rot will penetrate the rind and enter the juice sacs. The infected tissue shrinks and shows a clear line of separation between diseased and healthy rind tissue. The disease does not spread from decayed to healthy fruit.

#### *Sour Rot*

Tangerines are very susceptible to sour rot, especially over-mature fruit, plugged fruit, and fruit which have been de-greened with ethylene. The infected fruit becomes a watery mass that is very attractive to fruit flies and gives off a sour odour. Sour rot will spread by contact from one fruit to another. An effective material for control of sour rot is a postharvest dip or spray with sodium ortho-phenylphenate (0.9 kg/380 liters or 2 lb/100 gal).



**Technical bulletins also available on Waxing Fruits and Vegetables. Contact:**

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New Guyana Marketing Corporation

# TANGERINES

## Postharvest Care and Market Preparation Information Sheet



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