CBI
Ministry of Foreign Affairs

Product characteristics for fresh pineapples

When exporting to the EU, the most important characteristic of pineapples is it that they are non-climacteric fruits, which are harvested ripe. Therefore, it is very crucial not to harvest them to early, to consider the commercial attractiveness of its colour and to pack them properly. These issues are covered in this module for each variety – Smooth Cayenne, MD-2, Sugarloaf and Victoria.

This module gives an overview of the:

- Quality (different varieties and their specifications with regard to taste, shapes and sizes, ripeness and colour, etc.)
- Packaging specifications for each variety.

1. Varieties in the EU market

The pineapple (Ananas comosus) is a tropical plant with edible fruit of the *Bromiliaceae* family, having several different cultivars or types. All pineapple cultivars are non-climacteric fruits, i.e. the fruit must be harvested ripe on the plant because it will not continue to ripen once harvested. The most important cultivars available on the EU markets are:

- **Smooth Cayenne.** Until the mid-1990s, this was the cultivar primarily used for the fresh pineapple trade, with the majority of fresh pineapple exports being produced in West and Central Africa. The fruit was renowned for its characteristic orange/yellow colour and specific taste. Ripe fruits had a mixed acid/sugar taste. Smooth Cayenne is exported to the EU by sea or air freight.
- **MD-2 or Extra Sweet**. This cultivar is in fact a hybrid introduced to the trade by the Del Monte company. Although developed in Hawaii, MD-2 (Extra Sweet) was first grown commercially in Costa Rica before spreading to other Latin American countries (Ecuador, Panama and Honduras) but is now also grown in Africa (Ghana and Côte d'Ivoire).
  Although this cultivar is not as coloured as Smooth Cayenne, its flesh is more coloured than the colour of the Smooth Cayenne. More important, the fruit is very sweet without an acidic taste. The high sugar content producing very sweet tasting fruit has boosted pineapple consumption as well as fresh pineapple exports worldwide these past 20 years. Extra Sweet exports are generally only available by sea freight.
- **Sugarloaf**. Fruits of this cultivar are less well known, largely due to the fruit only being grown and exported from specific countries, mainly West Africa. The fruit is easily recognisable by its bottle shape. Depending on the soils on which they are grown, fruits of this cultivar are either dark green (Ghana) or coloured (Benin) or somewhere in between (Togo). Sugarloaf pineapples are only transported by air freight.
- **Victoria (Queen Victoria)** Although Victoria pineapples also originate from the *Bromiliaceae* family, the trade as well as specific fruit retailers consider them as "small exotics". Although most of the production available on the EU

markets originates from the Indian Ocean (South Africa, Mauritius and Reunion), some occasionally come from Africa (Ghana). These fruits are only available through the air freight market.

Photos of each variety can be found in the Module 'Product marketing for fresh pineapples' under 'Product presentation and promotion'.

Difficulties and constraints of the Ghanese pineapple sector
Due to the competition of the MD-2 from Costa Rica, the pineapples sector in Ghana was gradually eroded and has been re-structured in the beginning of the millennium. Large-scale farms in Ghana run by Compagnie Fruitière, Golden Exotics and the SPEG (group of large exporters) are growing MD-2 for export markets and other varieties for niche markets.

Opportunities were given in the Module ' Trade channels and market segments' under 'Key opportunities for West African exporters'.

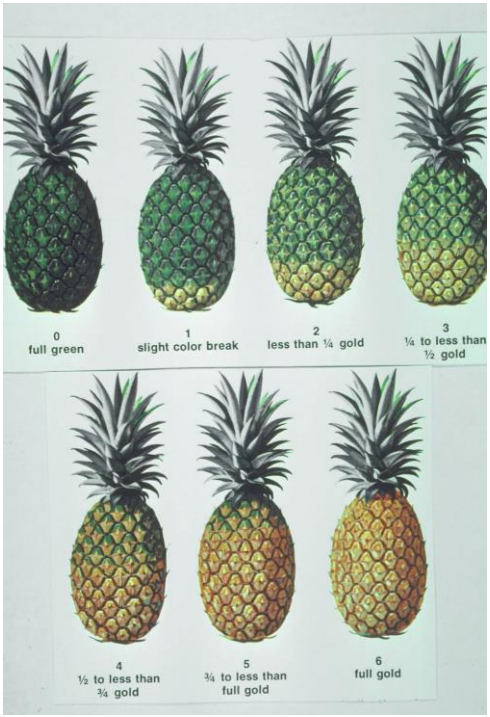
See also the Module 'Product competitiveness for fresh pineapples'.

Most smallholders in Ghana were unable to afford the high cost to produce MD-2 (US 17,500 for an acre) being more than 10 times higher than producing Smooth Cayenne (US$ 1,500/acre). The main problems were related to transport of the fruits fast to the cooling rooms (poor roads), non-payment by exporters, lack to detect diseases at an early stage and difficulties to comply to the strict EU legislation (Food security, GlobalGap). Therefore, they either stopped pineapple production for export markets, or work a labourers at large farms or produce smooth Cayenne for the local market, or for juice processors.

2. Smooth Cayenne

Quality - External aspects
At retail level, the fresh fruit is sold whole, i.e. complete with its crown. Although the crown of the Smooth Cayenne is generally without spines, in some cases small spines may be present. The crown should not exceed 1/3 of the length of the entire fruit. The cylindrical-shaped fruit has a skin containing several "eyes" (they are actually individual fruits), which are flat in appearance.

Colour
Change in colour of the "eyes" determines the colour of the fruit. The colour of the pineapple is important in triggering buyers' choices. The natural colouring of pineapples will depend not only on the variety but also on the climate and growing processes. For instance, the use of ethephon– a generator of ethylene which homogenises the colouring of fruits destined to be harvested –allows the producers to improve control of the production cycle, as well as affecting the colouring of the fruit. As mentioned, the colour of the fruit increases/decreases its" commercial attractiveness".



A colour chart has been developed for Smooth Cayenne. Colours are classified from C0 (least coloured) to C4 (the most coloured). C0 to C2 coloured fruits are generally recommended for sea transport. Whereas C3 and C4 coloured fruits are preferred on the air freight market.

C0: Fruit is entirely green

C1: One-quarter of the fruit begins to turn yellow/orange

C2: The fruit is yellow/orange on the half of its surface

C3: Two-thirds of the fruit are yellow/orange

C4: The fruit is yellow/orange all over.

Harvesting and °Brix

As non-climacteric fruits, pineapples are harvested ripe and can only evolve towards senescence (over-ripeness); the fruits must have completed their ripening process before being harvested. Fruits that are harvested too early will lack flavour and have a strong acidic taste. Their flesh will generally be whitish.
On the contrary, late-harvested fruit will be very sweet, with almost no acid taste, and their flesh yellow to dark yellow in colour, being not ideal for the market either.

The time of harvesting is therefore crucial. Fruit destined to travel by sea, will be harvested as soon as they are ripe to allow them to travel at least 14 days before reaching their final destination. On the other hand, fruit destined to go by air freight will be harvested as late as possible, i.e. having a sweeter taste. The sugar content in pineapples is expressed in Brix percentages or Degrees Brix (°Brix).
In an ideally ripe Smooth Cayenne, the Brix percentages should range between 12.8 and 14%. Below these figures, the fruit is too acidic, while above it is too fragile. Smooth Cayenne ripens from the base to the top. So, the flesh of the fruit will be sweeter at its base (peduncle) than at its top (near the crown).

Packaging

The packaging of Smooth Cayenne will vary according to the size of fruits as well as the method of transportation used, and in the case of air freight, some packaging differences may occur from one country to another.

Sea-freighted "Smooth Cayenne" fruits are packed in trays with fruits lying on their sides (head to tail, or crown to peduncle). Fruits are sorted and packed according to their weight.

There are five sizes:

Table 1: Size/weight/number ratio of sea freight packaging

Sizes	Weight correspondence (g)	Number of fruits per box
A6	1,801–2,100	6
A8	1,501–1,800	8
B9	1,301–1,500	9
B10	1,101–1,300	10
C12	900–1,100	12

Air freighted consignments are packed in boxes with fruits resting on the peduncle. Fruits are also packed according to their size. Not all sizes are available in exporting countries.

Table 2: Size/weight/number ratio of air freight packaging

Sizes	Weight correspondence (g)	Number of fruits per box
A1	1,801–2,000	6 (Benin, Cameroon, Ghana)
A2	1,501–1,800	6 (Benin, Cameroon, Ghana)
B3	1,301–1,500	6 (Benin, Ghana) and 12 (Cameroon)
B4	1,100–1,300	6 (Benin, Ghana) and 12 (Cameroon)

More information about packaging and labelling can be found in the Module 'Buyer requirements for fresh pineapples'.

3. Extra Sweet or MD-2

Quality - External aspects
The Crowns are different. At the retail level, fresh Extra Sweet may be found with or without its crown, although attempts to sell the fruit without a crown are not that successful. However, fruit without crowns maybe purchased by catering companies who are more concerned about the fruit itself than by its outward appearance. In the processing industry, crownless fruits are the standard.

When present, the crown generally does not have spines and there are no specific indicators related to its length. Although buyers are critical regarding the length of the crown.

Extra Sweet pineapples from Africa tend to have smaller crowns, while those from Latin America have longer crowns. Extra Sweet fruit is cylindrical in shape and closely resembles the Smooth Cayenne, having similar "eyes" (i.e. individual new fruits) although these eyes are generally much larger than those of the Smooth Cayenne.

The Extra Sweet eyes are also flat in appearance and, as for Smooth Cayenne, a change in eye colour determines the colour of the fruit. However, unlike the Smooth Cayenne, **the skin of the Extra Sweet is thicker** which makes the fruit less vulnerable to shocks and bruises, and therefore more suited to sea freight exports.

Degreening. As Extra Sweet production is always done on large-scale farms, the fruit is artificially degreened by the use of ethephon to facilitate harvesting and harmonise the colour of the fruit. Extra Sweet responds easily to ethephon, so doses employed are half those used for Smooth Cayenne.
It is important to stress that the degreening process is more specific for fruits grown in Africa (Ghana, Côte d'Ivoire). Latin American fruits hardly go through any degreening process and so the fruits are generally less coloured.

The fruit colour for Extra Sweet is based on an international colour chart that ranges from 0 to 6:

C0: Fruit is totally green, no traces of yellow

C1: Majority of the eyes are yellow over 20% of the area

C2: Majority of the eyes are yellow over 40% of the area

C3: All the eyes are yellow over 70% of their area

C4: All the eyes are yellow over 90% of the area with some green

C5: All the eyes are 10%yellow with green traces around each fruit let

C6: All the eyes are 100% yellow with no green colour at all.

Harvesting, translucency and °Brix
Despite being a hybrid, Extra Sweet remains a non-climacteric fruits, i.e. the fruit must have completed ripening before being harvested. Fruits that are harvested too early will lack flavour.

Their flesh will be pale, whitish in colour. Unlike the Smooth Cayenne where translucency is a sign of advanced maturity or over-ripeness, the flesh of the Extra Sweet will often present signs of translucency. However, over 50% translucency in the fruit will signify a short shelf life, while in Smooth Cayenne pineapples, this would indicate that the fruit are already decaying.

Brix percentages in an ideally ripe Extra Sweet should range between 14.5 and 16.5%. Similar to the Smooth Cayenne, the Extra Sweet ripens from base to top; however when harvested there is almost no difference in sweetness between the base and the top of the fruit. Because of the absence of acidity, the fruit has a very sweet taste, hence the name, Extra Sweet.

Fast increasing supply of MD-2. The 'new variety' has a relative long shelf life and very quickly attracted consumers - not only because of its sweet taste, but also because of its regular and steady quality and juiciness. At the end of the 1990s, when Extra Sweet had just been introduced to consumers by Del Monte, not many growers had access to planting material for MD-2. These are crowns, slips and suckers that are naturally produced by the plant.
But since this material has been available to more growers, MD-2 pineapples were increasingly sold to export markets. This has changed the nature of the pineapple trade and consumption in the western world including the EU.

Packaging
Extra Sweet pineapples available on the EU markets are packed and shipped by sea according to the following specifications. Fruits are laid in trays head to tail (crown to peduncle). There are seven sizes of fruits available on EU markets.

Table 3: Extra Sweet packaging ratios for sea freight

Sizes	Weight correspondence (g)	Number of fruits per box
A5	101–2,500	5
A6	1,776–2,100	6
A7	1,576–1,775	7
A8	1,351–1,575	8
B9	1,151–1,350	9
B10	1,001–1,150	10
C12	0.860–1,000	12

4. Queen Victoria or 'Victoria'

Quality - External aspects
At the retail level, the fresh fruit is sold whole, i.e. with its crown, which has a lot of little spines all along its leaves. The fruit is trapezoidal in shape. Unlike the Smooth Cayenne or the Extra Sweet, Queen Victoria pineapples are small fruits and the "eyes" are prominent. Although Victoria pineapples grown in the Indian Ocean will naturally change colour from green to orange/yellow, some producers are said to use ethephon to harmonise the colour of fruits.

The colour chart for Queen Victoria is similar to that of the Smooth Cayenne with colour ranging from CO to C4.

C0: Fruit is totally green

C1: Quarter of the fruit is yellow from the base to the top

C2: Half the fruit is yellow

C3: More than half of the length of the fruit is coloured yellow

C4: 100% fruit is yellow/orange.

Victoria pineapples are only shipped by air.

Harvesting, vulnerability and °Brix
As non-climacteric fruits, Victoria pineapples are harvested ripe. The flesh of the fruit is yellow. Because the fruits are shipped by air, they will be left to ripen as much as possible on the plant. The fruit is vulnerable and its flesh will show traces of bruising if not handled carefully.

Brix percentages in ideally ripe Victoria pineapples should range between 13.5 and 16%. There is no major difference in sweetness between the base and the top.

Packaging
There is no correlation between the size of the fruit and the weight of the packaging. Fruit sizes are generally determined by the number of fruits required in a box. Indicators here are mostly based on fruits observed in various markets.
Fruits are packed lying on their side in boxes according to the following indicators. There are six different fruit sizes.

Table 4: Packaging ratio of Victoria pineapples for air freight

Sizes	Weight correspondence (g)	Number of fruits per box
6	580–916	6
7	500–786	7
8	435–688	8
9	390–611	9
10	350–550	10
12	290–460	12

5. Sugarloaf

The trade in Sugarloaf pineapples, at least on EU markets, is rather recent (past 5–6 years) in comparison to the trade of the other pineapple cultivars. Technical indicators below mostly relate to comparison and to observations rather than to specific technical studies as the fruit is still rather "new" to the market.

Quality - External aspects
At the retail level, the fresh fruit is sold whole, i.e. with its crown. The crown is without spines. No specific indicators are given regarding the crown that, in some cases, can be long (Benin) or short (Ghana).

The fruit has the typical characteristic shape of a bottle. The skin of the fruit is composed in several "eyes" (that are in fact individual fruit lets) and are flat in appearance.

As for most pineapples, there is the possibility of degreening the fruit by using ethephon. However, it appears that for the time being fruit from Ghana is not degreened, and so Sugarloaf pineapples from Ghana are known to be very green in colour. Depending on the season, fruit from Benin and Togo will tend to be slightly more coloured, as previously mentioned, farmers from Benin degreen their Sugarloaf.

There are no specific indicators concerning the colour of the fruit. The trade tends to use the distinction established for Smooth Cayenne.

C0: Fruit is entirely green

C1: One-quarter of the fruit begins to turn yellow/orange

C2: The fruit is yellow/orange over half of its surface

C3: Two-thirds of the fruit is yellow/orange

C4: The fruit is yellow/orange on all surfaces.

Harvesting and °Brix
Like all other pineapples, Sugarloaf is harvested ripe. Depending on the soil on which the fruit is grown the flesh of the fruit can vary between white and pale yellow.
Brix percentages in ripe Sugarloaf generally range between 13.5 and 15%. The difference in sweetness between the base and the top is not pronounced.

Packaging
Sugarloaf pineapples are air freighted. There are no specific indicators related to the weight of fruits. Fruits are generally packed lying on their side according to the following indicators.

Table 5: Sugarloaf packaging ratio for air freight

Sizes	Number of fruits per box
8	8
10	10
12	12

6. Technical specification - summary

Table 6: Summary of technical specifications by cultivar

	Extra Sweet	Smooth Cayenne	Sugarloaf	Victoria
Fruit form	Cylindrical	Cylindrical	Bottle	Trapezoid
Fruit colour	Ranging from green to orange/ yellow	Ranging from green to orange/ yellow	Green or orange/ yellow depending on origin	Yellow–orange/ yellow
Fruit eye profile	Flat	Flat	Flat	Slightly prominent
Flesh colour	Yellow/dark yellow	Pale yellow	White or pale yellow	yellow
Flesh firmness	Medium	Medium	Medium	Medium
Brix – ranging from:	14.5–16.5%	12.8–14%	13.5–15%	13.5–16%
Flesh maturity homogeneity from bottom to top	Homogeneous	Decreases as you reach the top of the fruit	Average	Average

7. Storage and shelf-life of all varieties

Cold storage at a temperature of 4.44°C and lower causes chilling injury and breakdown in pineapples. At 7-8°C and above, 80-90% relative humidity and adequate air circulation, normal ripening progresses during and after storage.
At best, pineapples may be stored for no more than 4-6 weeks.
In Costa Rica the storage life of pineapples are prolonged by dipping the fruits in a wax emulsion containing a suitable fungicide. Irradiation extends the shelf life of half- ripe pineapples by about one week. The pineapple does not lend itself well to freezing, as it tends to develop off flavours.

8. Application and uses

Main uses
The flesh of the four pineapple varieties is cut up in various ways and eaten fresh, as dessert, in (fruit) salads, compotes, or is cooked in pies, cakes, puddings, or as a garnish on ham, or made into sauces or preserves. Asian people use pineapples in curries and various meat dishes.


Victoria or baby pineapple

Smooth Cayenne it also is suitable for canning, having sufficient fibre for firm slices and cubes as well as excellent flavour.

The Queen Victoria pineapples, or baby pineapples are sweet and have a bold, rich flavour. They have a fragrant, golden skin and brilliantly coloured yellow flesh. They are entirely edible, with no need to remove the core. Their small size makes them a perfect individual serving, or an exotic gift.

Sugarloaf pineapples are entirely edible up to their core, which is rather soft and a bit crunchy. It can be used in cocktails, blended drinks, baked goods or salads. They pair well with other tropical fruits such as banana, coconut or papaya. The high sugar content lends well to caramelizing and browning.

Other uses of pineapples

- There is a growing demand for pineapples as a beverage.
- Crushed pineapple, juice, nectar, concentrate, marmalade and other preserves are commercially prepared from the flesh remaining attached to the skin after the cutting and trimming of the central cylinder.
- All residual parts cores, skin and fruit ends are crushed and given a first pressing for juice to be canned as such or prepared as syrup used to fill the cans of fruit, or is utilized in confectionery and beverages, or converted into powdered pineapple extract which has various roles in the food industry.

This survey was compiled for CBI by ***Searce***
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