

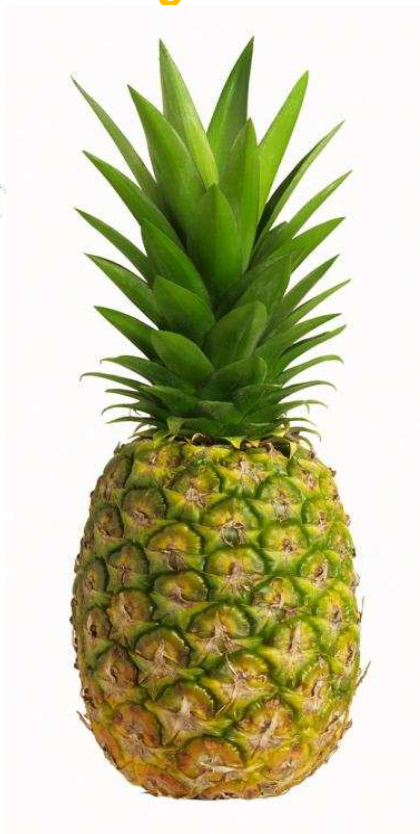


EAS 6:2010  
ICS 67.080.10

## EAST AFRICAN STANDARD

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Fresh pineapples — Specification and grading



EAST AFRICAN COMMUNITY

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HS 0804.30.00

## Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in East Africa. It is envisaged that through harmonized standardization, trade barriers which are encountered when goods and services are exchanged within the Community will be removed.

In order to meet the above objectives, the EAC Partner States have enacted an East African Standardization, Quality Assurance, Metrology and Test Act, 2006 (EAC SQMT Act, 2006) to make provisions for ensuring standardization, quality assurance, metrology and testing of products produced or originating in a third country and traded in the Community in order to facilitate industrial development and trade as well as helping to protect the health and safety of society and the environment in the Community.

East African Standards are formulated in accordance with the procedures established by the East African Standards Committee. The East African Standards Committee is established under the provisions of Article 4 of the EAC SQMT Act, 2006. The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the private sectors and consumer organizations. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the procedures of the Community.

Article 15(1) of the EAC SQMT Act, 2006 provides that "Within six months of the declaration of an East African Standard, the Partner States shall adopt, without deviation from the approved text of the standard, the East African Standard as a national standard and withdraw any existing national standard with similar scope and purpose".

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

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## Introduction

This second edition of this standard supersedes and cancels EAS 6:2000, *Fresh pineapples — Specification*

In the preparation of this East African Standard, the following sources were consulted extensively:

*United States Standards for Grades of Pineapples*, Effective May 2, 2008

UNECE STANDARD FFV 049:2003, *Marketing and commercial quality control of pineapples*

CODEX STAN 182:1993 (Rev. 2005), *Standard for Pineapple*

CODEX STAN 193:1995 (Rev.5:2009), *General Standard for Contaminants and Toxins in Foods*

CODEX STAN 228:2001 (Rev.1:2004), *General methods of analysis for contaminants*

CODEX STAN 230:2001 (Rev.1:2003), *Maximum levels for lead*

ISO 1838:1993, *Fresh pineapples — Storage and transport*

Codex Alimentarius website: [http://www.codexalimentarius.net/mrls/pestdes/jsp/pest\\_q-e.jsp](http://www.codexalimentarius.net/mrls/pestdes/jsp/pest_q-e.jsp)

USDA Foreign Agricultural Service website: <http://www.mrldatabase.com>

USDA Agricultural Marketing Service website: <http://www.ams.usda.gov/AMSV1.0/Standards>

USDA Plant Inspectorate Service website: [http://www.aphis.usda.gov/import\\_export/plants](http://www.aphis.usda.gov/import_export/plants)

European Union: [http://ec.europa.eu/sanco\\_pesticides/public](http://ec.europa.eu/sanco_pesticides/public)

Assistance derived from these sources and others inadvertently not mentioned is hereby acknowledged.

This standard has been developed to take into account:

- the needs of the market for the product;
- the need to facilitate fair domestic, regional and international trade and prevent technical barriers to trade by establishing a common trading language for buyers and sellers.
- the structure of the CODEX, UNECE, USA, ISO and other internationally significant standards;
- the needs of the producers in gaining knowledge of market standards, conformity assessment, commercial cultivars and crop production process;
- the need to transport the product in a manner that ensures keeping of quality until it reaches the consumer;
- the need for the plant protection authority to certify, through a simplified form, that the product is fit for crossborder and international trade without carrying plant disease vectors;
- the need to promote good agricultural practices that will enhance wider market access, involvement of small-scale traders and hence making fruit and vegetable production a viable means of wealth creation; and
- the need to keep unsatisfactory produce from the market by allowing the removal of unsatisfactory produce from the markets and to discourage unfair trade practices e.g. trying to sell immature produce at the beginning of the season when high profits can be made. Immature produce leads to dissatisfaction of customers and influences their choices negatively, which disadvantages those traders who have waited until the produce is mature.

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## Fresh pineapples — Specification and grading

### 1 Scope

This East African Standard applies to commercial varieties of pineapples grown from *Ananas comosus* (L.) Merr., of the *Bromeliaceae* family, to be supplied fresh to the consumer, after preparation and packaging. This standard provides guidance on the quality of pineapples from the harvesting, handling, grading, transport and packaging stages to marketing. It also specifies provisions concerning quality, sizing tolerances and presentation of the fruit to the market. Pineapples for ornamental use or industrial processing are excluded.

### 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

CAC/GL 21, *Principles for the Establishment and Application of Microbiological Criteria for Foods*

CAC/RCP 1, *Recommended International Code of Practice — General Principles of Food Hygiene*

CAC/RCP 44, *Recommended International Code of Practice for Packaging and Transport of Fresh Fruits and Vegetables*

CAC/RCP 53, *Code of Hygienic Practice for Fresh Fruits and Vegetables*

EAS 38, *Labelling of prepackaged foods — Specification*

ISO 6561-1, *Fruits, vegetables and derived products — Determination of cadmium content — Part 1: Method using graphite furnace atomic absorption spectrometry*

ISO 6561-1, *Fruits, vegetables and derived products — Determination of cadmium content — Part 2: Method using flame atomic absorption spectrometry*

ISO 6633, *Fruits, vegetables and derived products — Determination of lead content — Flameless atomic absorption spectrometric method*

CD/K/378:2010, *Horticultural industry — Code of practice*

### 3 Definitions

For the purpose of this standard the following definition shall apply:

#### 3.1

##### **foreign matter**

any foreign substance which affects the appearance and typical smell of the pineapple

#### 3.2

##### **diseased**

any unhealthy condition caused by any fungus, bacterium virus or pest

#### 3.3

##### **similar varietal characteristics**

the pineapples in any lot are similar in type and character of growth

#### 3.4

##### **mature**

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the pineapple has reached the stage of development where ripening has progressed to a degree where the fruit is usable and edible

### 3.5

#### **overripe**

the fruit is soft and past commercial utility

### 3.6

#### **stems removed**

the stem at the base of the fruit has been removed so that it does not extend more than one inch beyond the outermost bottom portion of the butt of the fruit

### 3.7

#### **well formed**

the fruit shows good shoulder development and is not lopsided or distinctly pointed, and that the sides are not noticeably flattened

### 3.8

#### **fairly well formed**

the fruit is not excessively lopsided, or excessively flattened at the shoulders or sides

### 3.9

#### **fairly uniform in size**

the weight of the fruit within individual containers does not vary more than 1-1/2 pounds from smallest to largest

### 3.10

#### **freezing injury or frozen (fruit)**

the edible flesh is glassy, watersoaked, and/or discolored characteristic of having been frozen or the fruit is affected by freezing so that some portion is in a hardened state with ice crystals present

### 3.11

#### **freezing injury or frozen (tops)**

the leaf tissue is glassy, watersoaked, and/or discolored as is characteristic of having been frozen or the tops are to some degree, hardened by freezing with ice crystals present

### 3.12

#### **single top**

the fruit has only one prominent main stem at the crown of the fruit

### 3.13

#### **crown slips**

the small secondary top growths at the crown of the fruit

### 3.14

#### **shell**

the external surface or rind of the fruit

### 3.15

#### **flesh**

the internal edible portion of the fruit

### 3.16

#### **similar varietal characteristic color for tops**

the tops in a lot may vary from a characteristic green to reddish-green color

### 3.17

#### **decay**

breakdown or disintegration of the tops or breakdown, disintegration or fermentation of the pineapple caused by bacteria or fungi

**3.18****internal breakdown**

a physiological deterioration which results in a watersoaked or brown or blackish discoloration

**3.19****injury**

any defect listed in the classification of defects (Clause 11) or any other defect or combination of defects which more than slightly detracts from the appearance, edible, or shipping quality of the fruit

**3.20****damage**

any defect listed in the classification of defects (Clause 11) or any other defect or combination of defects which materially detracts from the appearance, edible, or shipping quality of the fruit

**3.21****serious damage**

any defect listed in the classification of defects (Clause 11) or any other defect or combination of defects which seriously detracts from the appearance, edible, or shipping quality of the fruit

**3.22****reducing (of the crown)**

the mechanical destruction of the apical growing point in the heart of the crown during the growth period at about two months from harvest by means of a gouge or similar instrument. Done correctly, this leaves no visible scar at harvest and requires no special subsequent treatment.

**3.23****trimming**

the removal after harvest of dead, wilted or damaged leaves, either by hand or with a sharp blade. Only when explicitly so specified by a particular market outlet should the crowns be removed in their entirety.

**4 Provisions concerning quality****4.1 General**

- (a) Compliance with the provisions of this standard shall not excuse failure to comply with provisions of applicable national laws.
- (b) This standard is applicable to fresh pineapples with or without tops provided that pineapples with tops attached or with tops removed may not be commingled in the same container.

**4.2 Minimum requirements**

In all classes, subject to the special provisions for each class and the tolerances allowed, the pineapples must be:

- intact, complete with the crown, which may be reduced and/or trimmed;
- fresh in appearance, including the crown, which should be free of wilted, dry, loose or damaged leaves;
- sound, produce affected by rotting or deterioration such as to make it unfit for consumption is excluded;
- clean, practically free of any visible foreign matter;
- free of internal browning;
- practically free of pests;

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- practically free of damage caused by pests;
- free of pronounced blemishes, in particular unhealed cuts, bruising, scorching, holes, cracks (healed or not);
- free of damage caused by chilling or by high temperature;
- free of abnormal external moisture;
- free of any foreign smell and/or taste.

When a peduncle (stem) is present, it shall be no longer than 2.0 cm long and the cut must be transversal, straight and clean.

The development and condition of the pineapples must be such as to enable them:

- to withstand transport and handling, and
- to arrive in satisfactory condition at the place of destination.

### 4.3 Maturity requirements

The fruit must be physiologically ripe, i.e. without evidence of unripeness (opaque, flavourless, exceedingly porous<sup>1</sup> flesh) or over-ripeness (exceedingly translucent or fermented flesh).

A transverse section of the fruit must not reveal flesh that is excessively fibrous or lacking in aroma.

The “eyes” should be well-filled, according to the characteristics of the variety.

The pineapples must have been carefully picked and have reached an appropriate degree of maturity and ripeness in accordance with criteria proper to the variety and/or commercial type and to the area in which they are grown.

The total soluble solids content of the fruit flesh should be at least 12° Brix. For the determination of Brix degrees, a sample of the juice representative of all the fruit shall be taken.

### 4.4 Classification

Pineapples are classified in three classes defined below:

#### 4.4.1 “Extra” Class

Pineapples in this class must be of superior quality. They must be characteristic of the variety and/or commercial type.

They must be free from defects, with the exception of very slight superficial defects, provided that these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package.

The crown, if present, shall be simple and straight with no sprouts, and shall be between 50 and 150% of the length of the fruit for pineapples with untrimmed crowns.

Pineapples in this class shall meet the following specific requirements:

- (1) Basic requirements for fruit:
  - (i) Similar varietal characteristics;

<sup>1</sup>

Except in certain varieties such as those of the Queen Victoria which may have more porous flesh.

- (ii) Mature and fresh in appearance;
  - (iii) Well formed, firm and well-developed eyes; and,
  - (iv) Stems removed.
- (2) Basic requirements for tops:
- (i) Similar varietal characteristic colour;
  - (ii) Single stem;
  - (iii) Moderately straight;
  - (iv) Well attached to fruit; and,
  - (v) Not more than 1.5 times the length of the fruit.
- (3) Fruit free from:
- (i) Fresh cracks;
  - (ii) Evidence of rodent feeding;
  - (iii) Freezing injury or frozen;
  - (iv) Overripe; and,
  - (v) Decay.
- (4) Tops free from:
- (i) Crown slips;
  - (ii) Freezing injury or frozen; and,
  - (iii) Decay.
- (5) Fruit free from injury by:
- (i) Bruising;
  - (ii) Sunburn;
  - (iii) Gummosis;
  - (iv) Internal breakdown;
  - (v) Insects;
  - (vi) Healed cracks; and,
  - (vii) Mechanical or other means.
- (6) Tops free from injury by:
- (i) Discoloration; and,
  - (ii) Insects.
- (7) Tolerances (See Clause 6)

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### 4.4.2 Class I

Pineapples in this class must be of good quality. They must be characteristic of the variety and/or commercial type.

The following slight defects may be allowed, provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package:

- slight defects in shape;
- slight defects in colouring, including sun-scorch/sun-spots/sun-burns;
- slight skin defects (i.e. scratches, scars, scrapes and blemishes) not exceeding 4 per cent of the total surface area.

The defects must not, in any case, affect the pulp of the fruit.

The crown may be simple or double and straight or slightly curved, with no side-shoots and should not exceed 150 per cent of the length of the fruit. The maximum inclination of the crown should not exceed 30° from the longitudinal axis of the fruit.

The pineapples in this class shall meet the following specific requirements:

- (1) Basic requirements for fruit:
  - (i) Similar varietal characteristics;
  - (ii) Mature and fresh in appearance;
  - (iii) Well formed, firm and well-developed eyes; and,
  - (iv) Stems removed.
- (2) Basic requirements for tops:
  - (i) Similar varietal characteristic colour;
  - (ii) Single stem;
  - (iii) Not more than moderately curved;
  - (iv) Well attached to fruit; and,
  - (v) Not more than twice the length of the fruit.
- (3) Fruit free from:
  - (i) Fresh cracks;
  - (ii) Evidence of rodent feeding;
  - (iii) Freezing injury or frozen;
  - (iv) Overripe; and,
  - (v) Decay.
- (4) Tops free from:
  - (i) Freezing injury or frozen; and,

- (ii) Decay.
- (5) Fruit free from damage by:
  - (i) Bruising;
  - (ii) Sunburn;
  - (iii) Gummosis;
  - (iv) Internal breakdown;
  - (v) Insects;
  - (vi) Healed cracks; and,
  - (vii) Mechanical or other means.
- (6) Tops free from damage by:
  - (i) Discoloration;
  - (ii) Crown slips; and,
  - (iii) Insects.
- (7) Tolerances (See Clause 6)

#### 4.4.3 Class II

This class includes pineapples that do not qualify for inclusion in the higher classes, but satisfy the minimum requirements specified above.

The following defects may be allowed, provided the pineapples retain their essential characteristics as regards the quality, the keeping quality and presentation:

- defects in shape;
- defects in colouring, including sun-scorch;
- skin defects (i.e. scratches, scars, scrapes, bruises and blemishes) not exceeding 8 per cent of the total surface area.

The defects shall not, in any case, affect the pulp of the fruit.

The crown may be simple or double and straight or curved, with no side-shoots.

The pineapples in this class shall meet the following specific requirements:

- (1) Basic requirements for fruit:
  - (i) Similar varietal characteristics;
  - (ii) Mature; and,
  - (iii) Fairly well formed.
- (2) Basic requirements for tops:

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- (i) Similar varietal characteristic colour;
  - (ii) Well attached to fruit;
  - (iii) Not completely curved over; and,
  - (iv) Not more than two fairly well developed stems.
- (3) Fruit free from:
- (i) Fresh cracks;
  - (ii) Evidence of rodent feeding;
  - (iii) Freezing injury or frozen;
  - (iv) Overripe; and,
  - (v) Decay.
- (4) Tops free from:
- (i) Freezing injury or frozen; and,
  - (ii) Decay.
- (5) Fruit free from serious damage by:
- (i) Bruising;
  - (ii) Sunburn;
  - (iii) Gummosis;
  - (iv) Internal breakdown;
  - (v) Insects;
  - (vi) Healed cracks; and,
  - (vii) Mechanical or other means.
- (6) Tops free from serious damage by:
- (i) Discoloration; and,
  - (ii) Insects.
- (7) Tolerances (See Clause 6)

### 4.4.4 Classification by exterior colouring

Colour criteria of the fruit are as follows:

- C0: totally green exterior,
- C1: beginning to turn yellow/orange on  $\frac{1}{4}$  of the fruit surface,
- C2: yellow/orange on  $\frac{1}{2}$  of the fruit surface,

C3: yellow/orange on  $\frac{2}{3}$  of the fruit surface,

C4: totally yellow/orange fruit.

## 5 Provisions concerning sizing

Size is determined by the average weight of the fruit with a minimum weight of 700 g, except for small size varieties<sup>2</sup>, which can have a minimum weight of 250 g, in accordance with the following table:

For all classes, not more than 10 per cent by number or weight of pineapples not satisfying the requirements as regards sizing shall meet the size immediately above and/or below that indicated on the package.

The pineapples in each container shall be fairly uniform in size and the count shall be plainly stamped, stenciled, or otherwise marked on the container.

In order to allow for variations incident to proper packing, not more than 5 percent of the packages in any lot may fail to meet the requirements pertaining to size and marking.

Size Code	Average Weight (+/-12%) (in grams)	
	with crown	without crown
A	2750	2280
B	2300	1910
C	1900	1580
D	1600	1330
E	1400	1160
F	1200	1000
G	1000	830
H	800	660

Significant volumes of pineapples in international trade are packaged and sold by count per box. Boxes are packed to minimum weight expectations e.g. 10 kg, 20 lbs, 40 lbs, appropriate for the various markets. Fruit are segregated for packaging by weights which approximate the above size codes, but may not consistently fall within a single size code, but would retain the uniformity required by the code.

## 6 Provisions concerning tolerances

Tolerances in respect of quality and size shall be allowed in each package for produce not satisfying the requirements for the class indicated.

### 6.1 Quality tolerances

#### 6.1.1 "Extra" Class

5 per cent by number or weight of pineapples not satisfying the requirements of the class, but meeting those of Class I or, exceptionally, coming within the tolerances of that class: **Provided**, that included in this amount not more than the following percentages shall be allowed for the defects listed: 3 percent for defects causing serious damage, including in the latter amount not more than 1 percent for decay.

<sup>2</sup> Such as Queen Victoria variety.

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### 6.1.2 Class I

10 % by number or weight of pineapples not satisfying the requirements of the class, but meeting those of Class II or, exceptionally, coming within the tolerances of that class: **Provided**, that included in this amount not more than the following percentages shall be allowed for the defects listed: 6 % for defects causing serious damage, including in the latter amount not more than 2 % for decay.

### 6.1.3 Class II

10 per cent by number or weight of pineapples satisfying neither the requirements of the class nor the minimum requirements, with the exception that not more than 1 percent of the produce is affected by rotting or any other deterioration rendering it unfit for consumption.

## 6.2 Application of tolerances

The contents of individual samples in the lot, are subject to the following limitations: Individual samples shall have not more than double a specified tolerance except that at least two defective specimens may be permitted in any sample: **Provided**, That no more than one specimen affected by decay be permitted in any sample, and provided further, that the averages for the entire lot are within the tolerances specified for the grades.

## 7 Provisions concerning presentation

### 7.1 Uniformity

The contents of each package must be uniform and contain only pineapples of the same origin, variety or commercial type, quality and size.

In addition, for the "Extra" Class, uniformity in colouring and maturity is required.

The visible part of the contents of the package shall be representative of the entire contents.

### 7.2 Packaging

Pineapples must be packed in such a way as to protect the produce properly.

The material used inside the package must be new<sup>3</sup>, clean and of a quality such as to avoid causing any external or internal damage to the produce. The use of materials, particularly of paper or stamps bearing trade specifications is allowed, provided the printing or labelling has been done with non-toxic ink or glue.

Stickers individually affixed on the produce shall be such that, when removed, neither leave visible traces of glue, nor lead to skin defects.

Pineapples shall be packed in each container in compliance with the CAC/RCP 44. The containers shall meet the quality, hygiene, ventilation and resistance characteristics to ensure suitable handling, shipping and preserving of the pineapples. Packages must be free of all foreign matter and smell.

### 7.3 Presentation

The pineapples may be presented:

- laid down horizontally in the package,
- stood up vertically in the package with the crowns uppermost.

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<sup>3</sup> For the purposes of this Standard, this includes recycled material of food-grade quality.

## 8 Marking or labelling

### 8.1 Consumer packages

In addition to the requirements of EAC 38, the following specific provisions apply:

#### 8.1.1 Nature of produce

If the produce is not visible from the outside, each package should be labelled as to the name of the produce and may be labelled as to name of the variety and/or commercial type. The absence of the crown should be indicated.

### 8.2 Non-retail containers

Each package must bear the following particulars, in letters grouped on the same side, legibly and indelibly marked, and visible from the outside, or in the documents accompanying the shipment.

#### 8.2.1 Identification

The exporter, packer and/or dispatcher shall be identified by name and physical address (e.g. street/city/region/postal code and, if different from the country of origin, the country) or a code mark officially recognized by the national authority.

NOTE The national legislation of a number of countries requires the explicit declaration of the name and address. However, in the case where a code mark is used, the reference "packer and/or dispatcher (or equivalent abbreviations)" has to be indicated in close connection with the code mark, and the code mark should be preceded by the ISO 3166 (alpha) country/area code of the recognizing country, if not the country of origin.

#### 8.2.2 Nature of produce

Name of the produce if the contents are not visible from the outside. Name of the variety or commercial type (optional). The absence of the crown should be indicated.

#### 8.2.3 Origin of produce

Country of origin and, optionally, district where grown or national, regional or local place name.

#### 8.2.4 Commercial identification

- Class;
- Size (recognised size code or average weight in grams);
- Number of fruits;
- Net weight (optional).
- Coloration code (optional);
- Tare weight (optional);
- The indication "To be stored at 8° C" (optional)

NOTE The following is an example of a "recognized size code" that is in current commercial use.

A5:	fruit of 2,101 – 2,400 grams
A6:	fruit of 1,801 – 2,100 grams
A8:	fruit of 1,502 – 1,800 grams
B9:	fruit of 1,301 – 1,500 grams
B10:	fruit of 1,101 – 1,300 grams
C12:	fruit of 901 – 1,100 grams
D14:	fruit of 701 - 900 grams

#### 8.2.5 Official inspection mark (optional)

## 9 Contaminants

### 9.1 Heavy metals

Pineapples shall comply with those maximum levels for heavy metals established by the Codex Alimentarius Commission for this commodity. The current levels are as indicated below:

Metal	Unit of measurement	Maximum limit	Test method
Lead (Pb)	mg/kg	0.10	ISO 6633 (AAS)
Cadmium (Cd)	mg/kg	0.050	ISO 6561

### 9.2 Pesticide residues

Pineapples shall comply with those maximum pesticide residue limits established by the Codex Alimentarius Commission for this commodity. The table below provides current MRLs while Annex E provides current MRLs for the USA, EU and Codex markets.

#### Maximum pesticide residue limits and extraneous maximum residue limits in pineapples (current as at 2009-06-09)

Type	Unit symbol	Limit	Method of test	Notes
CARBENDAZIM	MRL (mg/kg)	5		
DIAZINON	MRL (mg/kg)	0.1		
DIMETHOMORPH	MRL (mg/kg) (*)	0.01		
DISULFOTON	MRL (mg/kg)	0.1		
ETHEPHON	MRL (mg/kg)	2		
HEPTACHLOR	EMRL (mg/kg)	0.01		
METHIDATHION	MRL (mg/kg)	0.05		
PROPICONAZOLE	MRL (undef)	0.02		
TRIADIMEFON	MRL (undef) Po	5		Based on triadimenol use only
TRIADIMENOL	MRL (undef) Po	5		Based on triadimenol use only

## 10 Hygiene

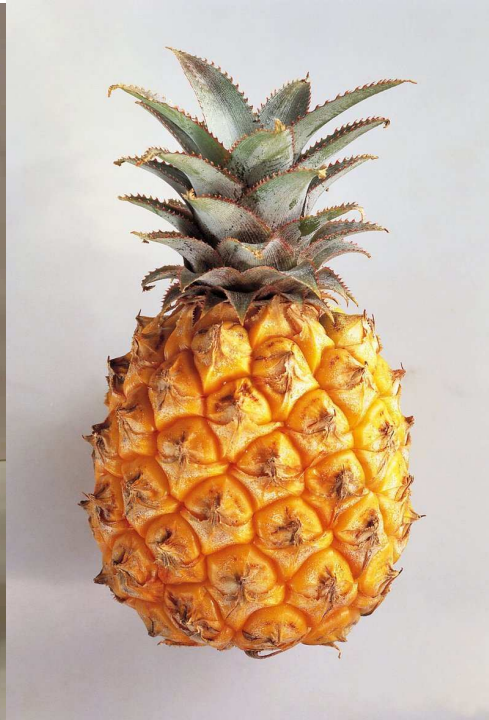
**10.1** It is recommended that the produce covered by the provisions of this Standard be prepared and handled in accordance with the appropriate sections of CAC/RCP 1, CAC/RCP 53, and other relevant Codex texts such as Codes of Hygienic Practice and Codes of Practice.

**10.2** The produce should comply with any microbiological criteria established in accordance with CAC/GL 21.

## 11 Classification of defects

Defects	Injury	Damage	Serious damage
<b>Tops:</b>			
Discoloration	When more than 10 percent of the crown leaves are discolored.	When more than 25 percent of the crown leaves are discolored.	When more than 50 percent of the crown leaves are discolored.
Crown slips	Free from.	When more than 5 crown slips or when more than 2 are over 69.85 mm in length.	
Mechanical or other means	When physical injury (cleanliness, mechanical damage) more than slightly affects the appearance of the pineapple.	When physical injury (cleanliness, mechanical damage) materially affects the appearance of the pineapple.	When physical injury (cleanliness, mechanical damage) seriously affects the appearance of the pineapple.
<b>Fruit:</b>			
Bruising	When any bruise extends into flesh more than 6.35 mm and when a bruise or combination of bruises affects an aggregate area of	When any bruise extends into flesh more than 12.7 mm and when a bruise or combination of bruises affects an aggregate area of	When any bruise extends into flesh more than 19.05 mm and when a bruise or combination of bruises affects an aggregate area of

	a circle more than 38.1 mm in diameter.	a circle more than 57.15 mm in diameter.	a circle more than 76.2 mm in diameter.
Sunburn	When there is bleaching and a slight softening of the shell affecting an aggregate area more than 38.1 mm in diameter.	When there is bleaching and a moderate softening of the shell affecting an aggregate area more than 57.15 mm in diameter.	When there is bleaching and severe softening of the shell affecting an aggregate area more than 76.2 mm in diameter.
Gummosis	When gum deposits penetrate into the flesh or causes discoloration of the shell affecting an aggregate area more than 6.35 mm in diameter.	When gum deposits slightly penetrate into the flesh or causes discoloration of the shell affecting an aggregate area more than 12.7 mm in diameter.	When gum deposits readily penetrate into the flesh or causes discoloration of the shell affecting an aggregate area more than 25.4 mm in diameter.
<b>Fruit:</b>			
Internal breakdown	When more than 5 percent of the edible flesh has a distinct light brown to medium brown discoloration which more than slightly detracts from the appearance or edible quality of the fruit.	When more than 10 percent of the edible flesh has a light to medium brown discoloration which materially detracts from the appearance or edible quality of the fruit.	When more than 20 percent of the edible flesh has a distinct medium to dark brown or brown-black discoloration which seriously detracts from the appearance or edible quality of the fruit.
Insects and insect feeding	When an aggregate area more than 12.7 mm in diameter has any insects attached to the surface (e.g. scale) or any injury from insect feeding, which more than slightly detracts from the appearance, edible, or shipping quality of the fruit.	When an aggregate area more than 19.05 mm in diameter has any insects attached to the surface (e.g. scale) or any injury from insect feeding, which materially detracts from the appearance, edible, or shipping quality of the fruit.	When an aggregate area more than 25.4 mm in diameter has any insects attached to the surface (e.g. scale) or any injury from insect feeding, which seriously detracts from the appearance, edible, or shipping quality of the fruit.
Healed cracks	When healed cracks more than slightly detract from the appearance, edible, or shipping quality of the fruit.	When healed cracks on the eyes are more than 12.7 mm in width and not more than 12.7 mm in depth or which materially detract from the appearance, edible, or shipping quality of the fruit. When healed cracks between the eyes materially affect the appearance of the fruit shell.	When healed cracks on the eyes are more than 19.05 mm in width and not more than 19.05 mm in depth or which seriously detract from the appearance, edible, or shipping quality of the fruit. When healed cracks between the eyes seriously affect the appearance of the fruit shell
Mechanical or other means	When physical injury (cleanliness, mechanical damage) more than slightly affects the appearance or edible quality of the pineapple.	When physical injury (cleanliness, mechanical damage) materially affects the appearance or edible quality of the pineapple.	When physical injury (cleanliness, mechanical damage) seriously affects the appearance or edible quality of the pineapple.



Standard



Draft for



Standard



cayenne pineapple



queen pineapple



red spanish pineapple

Draft for C



Young pineapples in field

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## Annex A (informative)

### Storage and transport

#### A.1 Introduction

Fresh pineapples produced in regions far from places of consumption should be stored in the cold.

The degree of maturity at harvest time, which determines the duration of storage, should be chosen according to the duration of transport and marketing operations. This duration varies considerably, hence the clause dealing with the ripeness of the pineapples cannot have a general application. The physiological condition of the fruit is defined by its suitability at the time of harvest for reaching the required state of ripeness for consumption, at the point of retail sale, after normal storage or transport.

The external coloration of the pineapples is not a safe criterion for maturity and it is necessary to give a criterion for actual ripeness.

The condition of the pineapples on arrival at the warehouse (physiological condition, soundness, injuries) has a direct bearing upon the behaviour during storage, which justifies the detailed recommendations made on this subject.

#### A.2 Scope

This annex gives guidance on conditions for the successful keeping, with or without the aid of artificial cooling, of fresh pineapples during storage between the place of production and the place of consumption and during maritime transport.

#### A.3 Definitions

For the purposes of this annex, the definitions given in Clause 3 and CD/K/378:2010 apply.

#### A.4 Conditions for harvesting and storage

##### A.4.1 Varieties

The products covered by this annex are fresh fruits, intended for storage and belonging to the cultivars covered in Annex D.

##### A.4.2 Harvesting

The degree of maturity of fresh pineapples should be determined in terms of their physiological condition) and the number of days which will elapse between harvesting and sale to the retailer. Harvest time is determined when the base of the fruit has changed in colour from green to yellow or light brown. Fruits may be harvested to be sold fresh before striking colour changes have occurred.

There are two degrees of maturity for the harvesting of pineapples:

- degree of maturity 1: green;
- degree of maturity 2: ripe.

##### A.4.3 Characteristics for storage

The pineapples should be whole, clean and firm, with a crown and a portion of the stem without bracts, well set, with well-developed eyes.

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They should not show signs of over-exposure to the sun, or deep cracks even if healed, or unhealed shallow cracks.

They should be free from apparent physiological disorders or apparent cryptogamic disorders, and from visible insects (ants, etc.). However, scale insects (*Dysmicoccus brevipes*) which are not damaging to crops from temperate countries are tolerated in small numbers.

The pineapples should not have unhealed injuries or recent bruises, as they are very sensitive to bruises, which systematically bring about decay in storage.

The flesh should not have numerous large brown patches appearing around the ovarian cavities on a cross-section of the fruit.

The fruit should not have a “hedgehog” shape, i.e. protuberant eyes, for cultivars other than the “Queen” group.

The part of the stem remaining attached to the fruit should have a length of between 10 mm and 30 mm and its cross-section should show a clean cut which should be disinfected by an agreed fungicide (for example, a powder based on benzoic acid). Shallow lateral injuries of the stem should also be disinfected.

Pineapples can be stored without their crown or with reduced crowns, provided that the base of the crown on the fruit is well healed and that it does not show bruises or decay.

### A.4.4 Putting into storage

The fruit should be put into storage as quickly as possible after harvesting.

The interval between harvesting the fruit and putting it into a refrigerated or ventilated enclosure (precooling room, ship's hold, freight container, etc.) should be, if possible, less than 24 h and should not in any case exceed 48 h.

After harvesting and packing, if the pineapples are waiting for a means of land transport to take them to the port of embarkation, they should be placed in the shade and in a well-ventilated area.

At the port of embarkation, the time during which the vans or trucks loaded with pineapples stand waiting before the fruit is put into the ship's hold should be reduced to a minimum, with the vehicles standing in the shade.

### A.4.5 Method of storage

Fresh pineapples should be stored in packages which protect them effectively against injuries and bruises caused by knocks during handling. They are generally

- either packed horizontally with protective elements in wooden boxes, chip baskets or board cases; or
- packed vertically in cardboard cases by means of an appropriate device.

As far as possible, pineapples of the Cayenne lisse variety, which are particularly susceptible to bruising, should not come into contact with the vertical walls of the packages.

### A.5 Optimum storage and transport conditions (in the case of artificial cooling)

For measurement of the physical quantities affecting storage, see CD/K/378:2010.

The storage and refrigerated transport of fresh pineapples comprise two stages: cooling and keeping at the storage temperature.

**A.5.1 Cooling**

Cooling of the pineapples should be carried out as quickly as possible. This can be achieved by means of

- a refrigeration plant with a capacity of 800 W to 930 W per tonne of pineapples;
- a cooling-air temperature of approximately 8 °C, without going below 8 °C;
- an air-circulation ratio from 80 to 100;
- stacking the packages containing the pineapples in a regular pattern, sufficiently close together to promote the maximum flow of air over the product;
- an effective air-circulation system (eliminating short-circuits of external air).

**A.5.2 Temperature**

After cooling, the storage temperature of pineapples should be as follows for fruits with a degree of maturity of:

- maturity 1 (green) over 10 °C, for 4 to 5 weeks
- maturity 2 (ripe) 5 °C to 9 °C for 4 to 5 weeks

This temperature is that of the atmosphere of the enclosure, measured at the coldest point (air leaving the refrigerator evaporator).

Any higher temperature leads to a decrease in the keeping time.

**A.5.3 Relative humidity**

The surface of the cold batteries of the air coolers should be so designed that, once the cooling of the pineapples is completed and the temperature stabilized, a relative humidity of 90 % to 95 % is maintained at the coldest Point of the refrigerated enclosure.

**A.5.4 Air circulation****A.5.4.1 Air-circulation ratio**

A ratio of 80 to 100 is recommended during cooling. It may be reduced by half during transport after the end of cooling.

The recommended system of ventilation is that with a vertically ascending or descending air flow in series with a uniform distribution of air over the intake end output surfaces.

**A.5.4.2 Rate of air change**

The recommended rate is one air change per hour. This rate may be reduced by half during the cooling period.

**A.6 Storage life**

The storage life of the pineapples depends on the degree of maturity; it is between 4 and 5 weeks from the time of harvesting.

**A.7 Wastage during storage**

Wastage of pineapples during storage is due to the following causes:


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- too low a storage temperature: temperature below +7 °C, with darkening of the centre of the pineapple and breakdown of the tissues; mainly for fruits at the degree of maturity 1 or 2;
- internal darkening caused by a physiological disorder resulting from unfavourable climatic and ecological factors;
- rotting caused by bruises arising from poor handling between harvesting and storage or from defective packaging;
- translucent flesh with the smell of alcoholic fermentation, resulting from storage of pineapples harvested when over-ripe;
- internal decay arising from a fungal infection (*Thielavopsis paradoxa*, *Fusarium* spp., *Penicillium* spp.). This wastage should not be considered as directly attributable to the storage. The fungal infection is produced because the fungus has found a way in through an injury, through a bruise or through the part of the stem which has not been disinfected at the harvesting or packaging stage.

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### Annex C (informative)

#### Model certificate of conformity with standards for fresh fruits and vegetables

1. Trader:	Certificate of conformity with the Community marketing standards applicable to fresh fruits and vegetables  No. ....  (This certificate is exclusively for the use of inspection bodies)		
2. Packer identified on packaging (if other than trader)	3. Inspection body		
	4. Place of inspection/country of origin (¹)	5. Region of country of destination	
6. Identifier of means of transport	7. <input type="checkbox"/> Internal <input type="checkbox"/> Import <input type="checkbox"/> Export		
8. Packages (number and type)	9. Type of product (variety if the standards specifies)	10. Quality Class	11. Total net weight in kg
12. The consignment referred to above conforms, at the time of issue, with the Community standards in force, vide:  <u>EAS 6:2010, Fresh pineapple — Specification and grading</u>  <hr style="width: 50%; margin-left: 0;"/> Customs office foreseen ..... Place and date of issue ..... Valid until (date): ..... Signatory (name in block letters): .....  <div style="display: flex; justify-content: space-around; width: 100%;"> <span>Signature</span> <span>Seal of competent authority</span> </div>			
13. Observations:			
(¹) Where the goods are being re-exported, indicate the origin in box 9.			

## Annex D (informative)

### Pineapple — Factsheet

#### D.1 Species and relations

**Related Species:** Pina de Playon (*Ananas bracteatus*).

**Distant affinity:** Pingwing (*Aechmea magdalenae*), Pinguin (*Bromelia pinguin*), Pinuela (*Karatas plumier*).

The pineapple is the leading edible member of the family Bromeliaceae which embraces about 2,000 species, mostly epiphytic and many strikingly ornamental. Now known botanically as *Ananas comosus* Merr. (syns. *A. sativus* Schult. f., *Ananassa sativa* Lindl., *Bromelia ananas* L., *B. comosa* L.), the fruit has acquired few vernacular names. It is widely called *pina* by Spanish-speaking people, *abacaxi* in the Portuguese tongue, *ananas* by the Dutch and French and the people of former French and Dutch colonies; *nanas* in southern Asia and the East Indies. In China, it is *po-lo-mah*; sometimes in Jamaica, sweet pine; in Guatemala often merely "pine".

#### D.2 Description

The pineapple plant is a terrestrial herb 0.75 - 1.5 m high with a spread of 0.9-1.2 m; a very short, stout stem and a rosette of waxy, straplike leaves, long-pointed, 50-180cm long; usually needle tipped and generally bearing sharp, upcurved spines on the margins. The leaves may be all green or variously striped with red, yellow or ivory down the middle or near the margins. At blooming time, the stem elongates and enlarges near the apex and puts forth a head of small purple or red flowers, each accompanied by a single red, yellowish or green bract. The stem continues to grow and acquires at its apex a compact tuft of stiff, short leaves called the "crown" or "top". Occasionally a plant may bear 2 or 3 heads, or as many as 12 fused together, instead of the normal one.

As individual fruits develop from the flowers they join together forming a cone shaped, compound, juicy, fleshy fruit to 30 cm or more in height, with the stem serving as the fibrous but fairly succulent core. The tough, waxy rind, made up of hexagonal units, may be dark-green, yellow, orange-yellow or reddish when the fruit is ripe. The flesh ranges from nearly white to yellow. If the flowers are pollinated, small, hard seeds may be present, but generally one finds only traces of undeveloped seeds. Offshoots, called "slips", emerge from the stem around the base of the fruit and shoots grow in the axils of the leaves. Suckers (aerial suckers) are shoots arising from the base of the plant at ground level; those proceeding later from the stolons beneath the soil are called basal suckers or "ratoons".

#### D.3 Origin and distribution

Native to southern Brazil and Paraguay (perhaps especially the Parana-Paraguay River) area where wild relatives occur, the pineapple was apparently domesticated by the Indians and carried by them up through South and Central America to Mexico and the West Indies long before the arrival of Europeans. Christopher Columbus and his shipmates saw the pineapple for the first time on the island of Guadeloupe in 1493 and then again in Panama in 1502. Caribbean Indians placed pineapples or pineapple crowns outside the entrances to their dwellings as symbols of friendship and hospitality. Europeans adopted the motif and the fruit was represented in carvings over doorways in Spain, England, and later in New England for many years. The plant has become naturalized in Costa Rica, Guatemala, Honduras and Trinidad but the fruits of wild plants are hardly edible.

Spaniards introduced the pineapple into the Philippines and may have taken it to Hawaii and Guam early in the 16th Century. The first sizeable plantation 5 acres (2 ha)—was established in Oahu in 1885. Portuguese traders are said to have taken seeds to India from the Moluccas in 1548, and they also introduced the pineapple to the east and west coasts of Africa. The plant was growing in China in 1594 and in South Africa about 1655. It reached Europe in 1650 and fruits were being produced in

Holland in 1686 but trials in England were not successful until 1712. Greenhouse culture flourished in England and France in the late 1700's. Captain Cook planted pineapples on the Society Islands, Friendly Islands and elsewhere in the South Pacific in 1777. Lutheran missionaries in Brisbane, Australia, imported plants from India in 1838. A commercial industry took form in 1924 and a modern canning plant was erected about 1946. The first plantings in Israel were made in 1938 when 200 plants were brought from South Africa. In 1939, 1350 plants were imported from the East Indies and Australia, but the climate is not a favorable one for this crop.

Over the past 100 years, the pineapple has become one of the leading commercial fruit crops of the tropics. In 1952-53, world production was close to 1,500,000 tons and reportedly nearly doubled during the next decade. Major producing areas are Hawaii, Brazil, Malaysia, Taiwan, Mexico, the Philippines, South Africa and Puerto Rico. By 1968, the total crop had risen to 3,600,000 tons, of which only 100,000 tons were shipped fresh (mainly from Mexico, Brazil and Puerto Rico) and 925,000 tons were processed. In the period 1961-66, imports of fresh pineapples into Europe rose by 70%. Soon many new markets were opening. In 1973, the total crop was estimated at 4,000,000 tons with 2.2 million tons processed. The increased worldwide demand for canned fruit has greatly stimulated plantings in Africa and Latin America.

#### D.4 Varieties

In international trade, the numerous pineapple cultivars are grouped in four main classes: 'Smooth Cayenne', 'Red Spanish', 'Queen', and 'Abacaxi', despite much variation in the types within each class.

**'Smooth Cayenne'** or 'Cayenne', 'Cayena Lisa' in Spanish (often known in India, Sri Lanka, Malaysia and Thailand as 'Sarawak' or 'Kew') was selected and cultivated by Indians in Venezuela long ago and introduced from Cayenne (French Guyana) in 1820. From there it reached the Royal Botanical Gardens, Kew, England, where it was improved and distributed to Jamaica and Queensland, Australia. Because of the plants near freedom from spines except for the needle at the leaftip and the size — 1.8 to 4.5 kg — cylindrical form, shallow eyes, orange rind, yellow flesh, low fiber, juiciness and rich mildly acid flavor, it has become of greatest importance worldwide even though it is subject to disease and does not ship well. Mainly, it is prized for canning, having sufficient fiber for firm slices and cubes as well as excellent flavor.

**'Hilo'** is a variant of 'Smooth Cayenne' selected in Hawaii in 1960. The plant is more compact, the fruit is smaller, more cylindrical; produces no slips but numerous suckers. It may be the same as the 'Cayenne Lisse' strain grown in Martinique and on the Ivory Coast, the fruit of which weighs 1 to 1.5 kg) and has a very small crown.

**'St. Michael'**, another strain of 'Smooth Cayenne'. The fruit weighs 2.25-2.75 kg, has a very small crown, a small core, is sweet with low acidity, and some regard it as insipid when fully ripe.

**'Giant Kew'** bears a large fruit averaging 2.75 kg, often up to 4.5 kg and occasionally up to 10 kg. The core is large and its extraction results in too large a hole in canned slices.

**'Charlotte Rothschild'** tapers toward the crown, is orange-yellow when ripe, aromatic, very juicy. The crop comes in early. 'Baron Rothschild', a Cayenne strain has a smaller fruit 0.8-2 kg in weight, marketed fresh.

**'Perolera'** (also called 'Tachirensis', 'Capachera', 'Motilona', and 'Lebrija') is a 'Smooth Cayenne' type. The plant is entirely smooth with no spine at the leaftip. The fruit is yellow, large — 3 to 4 kg — and cylindrical.

**'Bumanguesa'** is probably a mutation of 'Perolera'. The fruit is red or purple externally, cylindrical with square ends, shallow eyes, deep-yellow flesh, very slender core but has slips around the crown and too many basal slips to suit modern commercial requirements.

**'Monte Lirio'**, has smooth leaves with no terminal spine. The fruit is rounded, white-fleshed, with good aroma and flavor.

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'**Red Spanish**' is only fair for canning. The fruit is more or less round, orange-red externally, with deep eyes, and ranges from 1.36-2.7 kg. The flesh is pale-yellow, fibrous, with a large core, aromatic and flavorful. The fruit is hard when mature, breaks off easily and cleanly at the base in harvesting, and stands handling and transport well. It is highly resistant to fruit rot though subject to gummosis.

'**Cabezona**' ('Bull Head', or 'Pina de ague') is a prominent variant (a natural tetraploid) of 'Red Spanish' suited for semi-arid areas. The plant is large, over 1 m high; the leaves are gray-green. The fruit is conical but not as tall as that of 'Valera'; averages 1.8-2.75 kg and may reach 8 kg or more. It is orange-yellow at maturity, has few fibers and sweet-acid flesh. The stem is large and extends up into the base of the fruit and if the fruit is broken off when harvested it leaves a cavity. Consequently, it must be cut with a machete and later trimmed flush with the base in the packing house. It is marketed fresh only. It is resistant to gummosis.

'**Valera**' ('Negrita', or 'Andina'), is a small to medium plant with long, narrow, spiny, purple green leaves. The fruit is conical cylindrical, weighing 1.5-2.5 kg; is purple outside with white flesh.

'**Valera Amarilla**' is a 'Red Spanish' strain. The fruit is broad cylindrical and tall with a large crown; weighs 2-4 kg; is yellow externally with very deep eyes, about 72 to 88 in number. The flesh is pale-yellow and very sweet in flavor.

'**Valera Roja**', is a small-to-medium plant with cylindrical fruit 0.6-1 kg in weight, reddish externally, with 100 eyes. It has pale-yellow flesh.

'**Cumanesa**', supposedly a selection of 'Red Spanish', is a medium-sized plant, very spiny, producing an oblong fruit with a large crown. It is orange-yellow externally; weighs 0.9-1.70 kg and has yellowish-white flesh.

'**Monte Oscuro**' ('Pilon'), is a large plant with broad, sawtoothed, spiny-edged leaves. The fruit is barrel-shaped, large, weighing 3 kg; has 160-180 medium-deep eyes; is yellow outside with deep-yellow, fibrous flesh.

'**Abacaxi**' (also called 'White Abacaxi of Pernambuco', 'Pernambuco', 'Eleuthera', and 'English') plant is spiny and disease-resistant. Leaves are bluish-green with red-purple tinge in the bud. The numerous suckers need thinning out. The fruit weighs 1-5 kg, is tall and straight-sided; sunburns even when erect. It is very fragrant. The flesh is white or very pale yellowish, of rich, sweet flavor, succulent and juicy with only a narrow vestige of a core. This is rated by many as the most delicious pineapple. It is too tender for commercial handling, and the yield is low. The fruit can be harvested without a knife; breaks off easily for marketing fresh.

'**Sugarloaf**' (also called 'Pan de Azucar') is closely related to 'Abacaxi', and much appreciated in Central and South America, Puerto Rico, Cuba and the Philippines. The leaves of the plants and crowns pull out easily and this fact gave rise to the unreliable theory that pineapple ripeness is indicated by the looseness of the leaves. The fruit is more or less conical, sometimes round; not colorful; weighs 0.68-1.36 kg. Flesh is white to yellow, very sweet, juicy. This cultivar is too tender for shipping.

'**Brecheche**' is a small fruit with small, spineless crown. Average weight is 0.7-1 kg. The fruit is yellow externally. Flesh is yellow, with little fiber, small core, very fragrant, very juicy.

'**Caicara**', grown to a small extent in the State of Bolivar, Venezuela, is a large fruit weighing 4 to 5 1/2 lbs (1.8-2.5 kg). with a large, spiny crown. It is cylindrical conical with deep eyes; yellow externally with white flesh, a little fiber, very juicy, with large core.

'**Chocona**' and 'Sante Clara' are cultivars that have been introduced into Trinidad.

'**Congo Red**' is a plant with bright-red, long-lasting flowers. The fruit bends over and cracks in hot, dry weather. It weighs up to 2.25 kg, is waxy, with yellow flesh of good flavor.

**'Panare'**, named after the tribe of Indians that has grown it for a long time, is of medium size with long, spiny leaves. The fruit is bottle-shaped, small, 0.45-0.70 kg, with small crown; ovate, with deep eyes; orange externally with deep-yellow flesh; slightly fragrant, with little fiber and small core.

**'Mauritius'** (also known as 'European Pine', 'Malacca Queen', 'Red Ceylon' and 'Red Malacca') has dark green leaves with broad red central stripe and red spines on the margins. The fruit is small, 1.36-2.25 kg, yellow externally; has a thin core and very sweet flesh. It is sold fresh and utilized for juice.

**'Singapore Red'** (Also called 'Red Jamaica', 'Singapore Spanish', 'Singapore Queen', 'Singapore Common') has leaves that are usually all-green but sometimes have a reddish stripe near the margins; they are rarely spiny except at the tips. The fruits, cylindrical, reddish, with deep eyes, are small—1.6-2.25 kg—with slender core, fibrous, golden-yellow flesh; insipid raw but valued for canning. The plant is disease and pest-resistant.

The related 'Green Selangor' (also called 'Selangor Green', 'Green Spanish', and 'Selassie') of Malaysia has all-green leaves prickly only at the tips. The flesh is golden-yellow, often with white dots. This cultivar is grown for canning.

**'Queen'** (also called 'Common Rough' in Australia) is the leading cultivar in South Africa, Queensland and the Philippines. The plant is dwarf, compact, more cold-resistant and more disease-resistant than 'Smooth Cayenne'. It matures its fruit early but suckers freely and needs thinning, and the yield is low. The fruit is conical, deep-yellow, with deep eyes; weighs 0.45-1.13 kg; is less fibrous than 'Smooth Cayenne', but more fragrant; it is juicy, of fine flavor with a small, tender core. It is sold fresh and keeps well. It is only fair for canning because of its shape which makes for much waste.

**'Natal Queen'** of South Africa, also grown in El Salvador, produces many suckers. The fruit weighs 0.75-0.9 kg.

**'MacGregor'**, a variant of 'Natal Queen' selected in South Africa and grown also in Queensland, is a spreading, more vigorous plant with broad leaves and large suckers produced less freely. The fruit is cylindrical, medium to large, with firm flesh and flavor resembling 'Queen'.

**'James Queen'** (formerly 'Z') is a mutation of 'Natal Queen' that originated in South Africa. It has larger fruit with square shoulders.

**'Ripley'** or 'Ripley Queen', grown in Queensland, is a dwarf, compact plant with crimson tinge on leaves; takes 22 weeks from flowering to fruit maturity; is an irregular bearer. The fruit weighs 1.36-2.7 kg; is pale-copper externally; flesh is pale-yellow, non-fibrous, very sweet and rich.

**'Alexandria'**, a selection of 'Ripley Queen' in Queensland, is more vigorous with large suckers and fruit. The fruit is conical, tender, with 'Ripley Queen' flavor.

**'Egyptian Queen'** fruit weighs 0.9-1.8 kg.

**'Kallara Local'** is a little-known cultivar in India. Minor strains in Thailand are 'Pattavia', 'Calcutta', 'Sri Racha', 'Intorachit' and 'Chantabun'.

In the evaluation of pineapples, the crown can be an asset or a liability. Small crowns detract from the decorative appearance of the fruit; large crowns are more attractive but hamper packing and constitute too great a proportion of inedible material from the standpoint of the purchaser.

#### D.5 Climate

The pineapple is a tropical or near tropical plant limited (except in greenhouses) to low elevations between 30°N and 25°S. A temperature range of 18.33 -45°C is most favorable, though the plant can tolerate cool nights for short periods. Prolonged cold retards growth, delays maturity and causes the fruit to be more acid. Altitude has an important effect on the flavor of the fruit. At higher elevations the fruit is too acid. In Kenya, pineapples grown at 4500 ft (1371 m) are too sweet for canning; between 4500 and 5700 ft (1371-1738 m) the flavor is most suitable for canning; above 5700 ft (1738 m) the flavor is undesirably acid.

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Ideally, rainfall would be about 1,143 mm; though the pineapple is drought tolerant and will produce fruit under yearly precipitation rates ranging from 650-3,800 mm, depending on cultivar and location and degree of atmospheric humidity. The latter should range between 70 and 80 degrees.

### D.6 Soil

The best soil for pineapple culture is a well-drained, sandy loam with a high content of organic matter and it should be friable for a depth of at least 60 cm, and pH should be within a range of 4.5 to 6.5. Soils that are not sufficiently acid are treated with sulfur to achieve the desired level. If excess manganese prevents response to sulfur or iron, as in Hawaii, the plants require regular spraying with very weak sulfate or iron. The plant cannot stand waterlogging and if there is an impervious subsoil, drainage must be improved. Pure sand, red loam, clay loam and gravelly soils usually need organic enrichment.

### D.7 Propagation

Crowns (or "tops"), slips (also called nibs or robbers), suckers and ratoons have all been commonly utilized for vegetative multiplication of the pineapple. To a lesser degree, some growers have used "stumps", that is, mother plant suckers that have already fruited. Seeds are desired only in breeding programs and are usually the result of hand pollination. The seeds are hard and slow to germinate. Treatment with sulfuric acid achieves germination in 10 days, but higher rates of germination (75-90 %) and more vigorous growth of seedlings results from planting untreated seeds under intermittent mist.

The seedlings are planted when 15-18 months old and will bear fruit 16-30 months later. Vegetatively propagated plants fruit in 15-22 months.

Vegetative propagation does not assure facsimile reproduction of pineapple cultivars, as many mutations and distinct clones have occurred in spite of it.

### D.8 Culture

The land should be well prepared at the outset because the pineapple is shallow-rooted and easily damaged by post-planting cultivation. Fumigation of the soil contributes to high quality and high yields.

Fruit weight has been considerably increased by the addition of magnesium. Fruit size and total yield have been enhanced by applying chelated iron with nitrogen; also, where chlorosis is conspicuous, by accompanying nitrogen with foliar sprays of 0.10% iron and manganese.

Some growers thin out suckers and slips to promote stronger growth of those that remain.

**Irrigation:** Irrigation is desirable only in dry seasons and should not exceed 2.5 cm semi-monthly.

**Weed Control:** Manual weeding in pineapple fields is difficult and expensive. It requires protective clothing and tends to induce soil erosion. The use of paper or plastic mulch and timely application of approved herbicides are the best means of preventing weed competition with the pineapple crop.

**Flower Induction:** Pineapple flowering may be delayed or uneven, and it is highly desirable to attain uniform maturity and also to control the time of harvest in order to avoid overproduction in the peak periods. Use of professional advice should be sought.

### D.9 Pests

Nematodes (*Rotylenchulus*, *Meloidogyne*, *Pratylenchus*, *Ditylenchus*, *Helicotylenchus*, and other genera) cause stunting and degeneration in pineapple plants unless soil is fumigated.

Mealybugs (*Pseudococcus brevipes* and *P. neobrevipes*) attack leaf bases and cause wilt. The leaves turn orange-brown and wither due to root rot. Prevention requires spraying and dusting to control the

fire ants (*Solenopsis* spp.) which carry the mealybugs from diseased to healthy plants. Control is difficult because there are many weeds and other local plants acting as mealybug hosts. Some success was achieved in Florida in combatting mealybugs with the parasitic wasp, *Hambletonia pseudococcia* Comp., though the general use of insecticides limits the activity of the wasp.

The pineapple mite, or so-called red spider (*Dolichote-tranychus* (or *Stigmaeus*) *floridanus* (Banks) also attacks leaf bases and is troublesome during prolonged droughts, heavily infesting the slips. The pineapple red scale (*Diaspis bromeliae*) is also a problem. Natural predators afford about 40% control. The palmetto beetle (*Rhynchophorus cruentatus*), which feeds on palm logs, enters the bud and lays eggs in young fruits and the fruit stalk.

The sap beetle (*Carpophilus humeralis*) is one of the main enemies of pineapple fruits and is especially attracted to fruits affected by gummosis. Populations have been diminished by sanitary procedures and growing of cultivars resistant to gummosis, and chemical control is being evaluated.

In Brazil, larvae of the large moth, *Castnia licus*, and of the butterfly, *Thecla basilides*, damage the fruit. The latter is a problem in other parts of tropical America also and in Trinidad.

Cutworms eat holes in the base of the immature fruit. Fruit fly larvae do not pupate in 'Smooth Cayenne' but new hybrids lack resistance and may require treatment.

In New South Wales, poison baits are employed to combat fruit damage by crows, rats and mice. Rats may eat the base of the stem and destroy ratoons and suckers. Rabbits eat the leaves as high as they can reach.

#### D.10 Diseases

Top rot and root rot are caused by the soil fungi *Phytophthora cinnamomi* and *P. nicotianae* var. *parasitica* which are most prevalent in prolonged wet weather. Improved drainage helps reduce the risk and monthly spraying with fungicide gives good control. *P. cinnamomi* may also cause rot in green fruit on ratoons. These diseases are largely prevented by the use of paper or plastic mulch on raised beds.

Base rot is caused by the fungus *Ceratocystis paradoxa*, especially where drainage is poor. The imperfect form (conidial state) of this fungus, known as *Thielaviopsis paradoxa*, causes butt rot in planting material, also soft rot or breakdown of fruits during shipment and storage. If 1/4-ripe 'Red Spanish' fruits are kept at temperatures 7 °C - 8 °C while in transit, soft rot will not develop.

*Fusarium* spp. in the soil are the source of wilt. Black heart is a physiological disorder not visible externally, usually occurring particularly in locations where air flow is inadequate. Highest incidence in West Africa has been reported in midsummer. It begins as "endogenous brown spot" at the base of the fruitless close to the core. Later, affected areas merge. It has been attributed to chilling or low light intensity from dense planting or cloudiness. It can be controlled by one-day heat treatment at 32°-38°C before or after refrigerated storage.

Yellow spot virus on leaves is transmitted by *Thrips tabaci* Lind. Black speck and water blister are mentioned among other problems of the pineapple.

A condition called Crookneck is caused by zinc deficiency. It occurs mainly in plants 12-15 months old but is also frequent in suckers. The heart leaves become curled and twisted, waxy, brittle, and light yellowish-green. Sometimes the plant bends over and grows in a nearly horizontal position. Small yellow spots appear near the edges of the leaves and eventually merge and form blisters. Later, these areas become grayish or brownish and sunken. Treatment is usually a 1% solution of zinc sulfate. Many growers use a combined spray of 10% urea, 2% iron sulfate and 1% zinc sulfate. If burning occurs the proportion of urea should be changed to 5%. Excessive use of urea for this or any other purpose can lead to leaf tip dieback and yellowing of older leaves due to the biuret content in urea.

Copper deficiency is evident in concave leaves with dead tips and waxiness without bloom on the underside.

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Sunburn or sunscald develops when fruits fall over and expose one side to the sun, though 'Abacaxi' may sunburn even when erect. Affected fruits soon rot and become infested with pests. They must be cut as soon as noticed and safely disposed of where they will not contaminate other fruits. Dry grass, straw, excelsior or brown paper sleeves may be placed over fruits maturing in the summer to prevent sunburn.

### D.11 Harvesting

It is difficult to judge when the pineapple is ready to be harvested. The grower must depend a great deal on experience. Size and color change alone are not fully reliable indicators. Conversion of starch into sugars takes place rapidly in just a few days before full maturity. Fruits for canning are allowed to attain a more advanced stage. But overripe fruits are deficient in flavor and highly perishable.

Maturity studies conducted with 'Giant Kew' in India showed that highest quality is attained when the fruit is harvested at a specific gravity of 0.98-1.02, total soluble solids of 13.8-17%, or total soluble solids/acid ratio of 20.83-27.24 with development of external yellow color. Some people judge ripeness and quality by snapping a finger against the side of the fruit. A good, ripe fruit has a dull, solid sound; immaturity and poor quality are indicated by a hollow thud.

### D.12 Life of plantation

In current practice, after the harvesting of the first crop, workers trim off all but 2 ratoons which will bear fruit in 15-18 months. Perhaps there may be a second or third ratoon crop. Then the field is cleared to minimize carryover of pests and diseases. The method will vary with the interest in or practicality of making use of by products. Field practices will differ if pineapples are interplanted with other crops.

### D.13 Storage

Conditions for storage are elaborated in Annex A.

### D.14 Food uses

The flesh of larger fruits is cut up in various ways and eaten fresh, as dessert, in salads, compotes and otherwise, or cooked in pies, cakes, puddings, or as a garnish on ham, or made into sauces or preserves.

Canned pineapple is consumed throughout the world. The highest grade is the skinned, cored fruit sliced crosswise and packed in sirup. Undersize or overripe fruits are cut into "spears", chunks or cubes. Surplus pineapple juice used to be discarded after extraction of bromelain (q.v.). Today there is a growing demand for it 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 sirup 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. Chlorophyll from the skin and ends imparts a greenish hue that must be eliminated and the juice must be used within 20 hours as it deteriorates quickly. A second pressing yields "skin juice" which can be made into vinegar or mixed with molasses for fermentation and distillation of alcohol.

Young, tender shoots are eaten in salads. The terminal bud or "cabbage" and the inflorescences are eaten raw or cooked. Young shoots, called "*hijos de pina*" are sold on vegetable markets in Guatemala.

Sugar/acid ratio and ascorbic acid content vary considerably with the cultivar. The sugar content may change from 4% to 15% during the final 2 weeks before full ripening.

Table D.1 — Food value per 100 g of edible portion\*

Moisture	81.3 — 91.2 g
Ether Extract	0.03 — 0.29 g
Crude Fiber	0.3 — 0.6 g
Nitrogen	0.038 — 0.098 g
Ash	0.21 — 0.49 g
Calcium	6.2 — 37.2 mg
Phosphorus	6.6 — 11.9 mg
Iron	0.27 — 1.05 mg
Carotene	0.003 — 0.055 mg
Thiamine	0.048 — 0.138 mg
Riboflavin	0.011 — 0.04 mg
Niacin	0.13 — 0.267 mg
Ascorbic acid	27.0 — 165.2 mg

\*Analyses of ripe pineapple made in Central America.

### D.15 Toxicity

When unripe, the pineapple is not only inedible but poisonous, irritating the throat and acting as a drastic purgative. Excessive consumption of pineapple cores has caused the formation of fiber balls (bezoars) in the digestive tract.

### D.16 Other uses

#### Bromelain

The proteolytic enzyme, bromelain, or bromelin, was formerly derived from pineapple juice; now it is gained from the mature plant stems salvaged when fields are being cleared. The enzyme is used like papain from papaya for tenderizing meat and chill proofing beer; is added to gelatin to increase its solubility for drinking; has been used for stabilizing latex paints and in the leather-tanning process. In modern therapy, it is employed as a digestive and for its anti-inflammatory action after surgery, and to reduce swellings in cases of physical injuries; also in the treatment of various other complaints.

#### Fiber

Pineapple leaves yield a strong, white, silky fiber. Certain cultivars are grown especially for fiber production and their young fruits are removed to give the plant maximum vitality. The 'Perolera' is an ideal cultivar for fiber extraction because its leaves are long, wide and rigid.

#### Juice

Pineapple juice has been employed for cleaning machete and knife blades and, with sand, for scrubbing boat decks.

#### Animal feed

Pineapple crowns are sometimes fed to horses if not needed for planting. Final pineapple waste from the processing factories may be dehydrated as "bran" and fed to cattle, pigs and chickens. "Bran" is also made from the stumps after bromelain extraction. Expendable plants from old fields can be processed as silage for maintaining cattle when other feed is scarce. The silage is low in protein and high in fiber and is best mixed with urea, molasses and water to improve its nutritional value.

#### Folk medicine

Pineapple juice is taken as a diuretic and to expedite labor, also as a gargle in cases of sore throat and as an antidote for seasickness. The flesh of very young (toxic) fruits is deliberately ingested to achieve abortion (a little with honey on 3 successive mornings); also to expel intestinal worms; and as a drastic treatment for venereal diseases. In Africa the dried, powdered root is a remedy for edema. The crushed rind is applied on fractures and the rind decoction with rosemary is applied on hemorrhoids. Indians in Panama use the leaf juice as a purgative, emmenagogue and vermifuge.

#### Ornamental value

The pineapple fruit with crown intact is often used as a decoration and there are variegated forms of the plant universally grown for their showiness indoors or out.

## Annex E (informative)

### Fresh pineapple — Codex, EU and USA pesticide residue limits

Users are advised that international regulations and permissible Maximum Residue Levels (MRL) frequently change. Although this International MRL Database is updated frequently, the information in it may not be completely up-to-date or error free. Additionally, commodity nomenclature and residue definitions vary between countries, and country policies regarding deferral to international standards are not always transparent. This database is intended to be an initial reference source only, and users must verify any information obtained from it with knowledgeable parties in the market of interest prior to the sale or shipment of any products. The developers of this database are not liable for any damages, in whole or in part, caused by or arising in any way from user's use of the database.

#### Results Key

MRL values in *{Italics}* are more restrictive than US

--- indicates no MRL value is established.

Cod, EU, etc. indicates the source of the MRL and EXP means the market defers to the exporting market.

All numeric values listed are in parts per million (ppm), unless otherwise noted

	US	Cod	EU 1
<b>1-Naphthaleneacetic acid</b>	0.05	---	0.05
	1. European Union does not maintain a specific MRL for the 1-Naphthaleneacetic acid/Pineapple combination, but does maintain an MRL of 0.05 PPM for its "Miscellaneous fruit" group.		
	US	Cod	EU
<b>Ametryn</b>	0.05	---	---
	US	Cod	EU
<b>Bromacil</b>	0.1	---	---
	US	Cod	EU
<b>Carbaryl</b>	2	---	<i>{0.05}</i>
	US	Cod	EU
<b>Diazinon</b>	0.5	<i>{0.1}</i>	<i>{0.3}</i>
	US	Cod	EU 2
<b>Diuron</b>	0.1	---	0.1
	2. EU does not maintain a specific MRL for the Diuron/Pineapple combination, but does maintain an MRL of 0.1 PPM for its "Inedible peel, large" group.		
	US	Cod	EU 3
<b>Endosulfan</b>	1	---	<i>{0.05}</i>
	3. European Union does not maintain a specific MRL for the Endosulfan/Pineapple combination, but does maintain an MRL of 0.05 PPM for its "Miscellaneous fruit" group.		
	US	Cod	EU 4
<b>EPTC</b>	0.1	---	<i>{0.05}</i>
	4. European Union does not maintain a specific MRL for the EPTC/Pineapple combination, but does maintain an MRL of 0.05 PPM for its "Fruit Fresh or Frozen; Nuts" group.		
	US	Cod	EU
<b>Ethephon</b>	2	2	2
	US	Cod	EU 5
<b>Ethoprop</b>	0.02	---	0.02
	5. EU does not maintain a specific MRL for the Ethoprop/Pineapple combination, but does maintain an MRL of 0.02 PPM for its "Fruit Fresh or Frozen; Nuts" group.		
	US	Cod	EU
<b>Fosetyl-Al</b>	0.1	---	50
	US	Cod	EU 6
<b>Glyphosate</b>	0.1	---	0.1
	6. European Union does not maintain a specific MRL for the Glyphosate/Pineapple combination, but does maintain an MRL of 0.1 PPM for its "Inedible peel, large" group.		

	<b>US</b>	<b>Cod</b>	<b>EU</b>
<b>Hexazinone</b>	0.6	---	---
	<b>US</b>	<b>Cod</b>	<b>EU</b>
<b>Hydramethylnon</b>	0.05	---	---
	<b>US</b>	<b>Cod 7</b>	<b>EU</b>
<b>Inorganic bromide from fumigation</b>	20	20	50
	7. Codex does not maintain a specific MRL for the Inorganic bromide resulting from fumigation/Pineapple combination, but does maintain an MRL of 20 PPM for its "Fruits (except as otherwise listed)" group.		
	<b>US</b>	<b>Cod</b>	<b>EU 8</b>
<b>Malathion</b>	8	---	{0.02}
	8. EU does not maintain a specific MRL for the Malathion/Pineapple combination, but does maintain an MRL of 0.02 PPM for its "Miscellaneous fruit" group.		
	<b>US</b>	<b>Cod</b>	<b>EU 9</b>
<b>Metalaxyl</b>	0.1	---	{0.05}
	9. EU does not maintain a specific MRL for the Metalaxyl/Pineapple combination, but does maintain an MRL of 0.05 PPM for its "Miscellaneous fruit" group.		
	<b>US</b>	<b>Cod</b>	<b>EU</b>
<b>O-phenylphenol</b>	10	---	---
	<b>US</b>	<b>Cod</b>	<b>EU 10</b>
<b>Oxamyl</b>	1	---	{0.01}
	10. EU does not maintain a specific MRL for the Oxamyl/Pineapple combination, but does maintain an MRL of 0.01 PPM for its "Miscellaneous fruit" group.		
	<b>US</b>	<b>Cod 11</b>	<b>EU 12</b>
<b>Paraquat dichloride</b>	0.05	{0.01}	{0.02}
	11. Codex does not maintain a specific MRL for the Paraquat dichloride/Pineapple combination, but does maintain an MRL of 0.01 PPM for its "Assorted tropical and sub-tropical fruits - inedible peel" group.		
	12. European Union does not maintain a specific MRL for the Paraquat dichloride/Pineapple combination, but does maintain an MRL of 0.02 PPM for its "Fruit Fresh or Frozen; Nuts" group.		
	<b>US</b>	<b>Cod</b>	<b>EU</b>
<b>Piperonyl Butoxide</b>	8	---	---
	<b>US</b>	<b>Cod</b>	<b>EU</b>
<b>Propiconazole</b>	4.5	{0.02}	{0.05}
	<b>US</b>	<b>Cod</b>	<b>EU 13</b>
<b>Pyrethrins</b>	1	---	1
	13. EU does not maintain a specific MRL for the Pyrethrins/Pineapple combination, but does maintain an MRL of 1 PPM for its "Fruit Fresh or Frozen; Nuts" group.		
	<b>US</b>	<b>Cod</b>	<b>EU 14</b>
<b>Pyriproxyfen</b>	0.3	---	{0.05}
	14. EU does not maintain a specific MRL for the Pyriproxyfen/Pineapple combination, but does maintain an MRL of 0.05 PPM for its "Miscellaneous fruit" group.		
	<b>US</b>	<b>Cod</b>	<b>EU</b>
<b>Spinosad</b>	0.02	---	0.02
	<b>US</b>	<b>Cod 15</b>	<b>EU</b>
<b>Triadimefon</b>	2	5	3
	15. The MRL accommodates post-harvest treatment of the commodity.		
	<b>US</b>	<b>Cod</b>	<b>EU 16</b>
<b>Triflumizole</b>	4	---	{0.1}
	16. EU does not maintain a specific MRL for the Triflumizole/Pineapple combination, but does maintain an MRL of 0.1 PPM for its "Miscellaneous fruit" group.		

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