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## EAST AFRICAN STANDARD

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Pomegranate fruit — Specification and test methods



EAST AFRICAN COMMUNITY

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## 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

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

ISO 23393:2006, *Pomegranate fruit — Specification and test methods*

*Fruits and Vegetables Grading and Marking Rules*, 2004, Ministry of Agriculture, Government of India, Schedule V, *Grade Designation and Quality of Pomegranate*.

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 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.

**Contents**

1	Scope.....	1
2	Normative references.....	1
3	Definitions.....	1
4	Provisions concerning quality.....	2
4.1	General.....	2
4.2	Minimum requirements.....	2
4.3	Classification.....	2
5	Provisions concerning sizing.....	3
6	Provisions concerning tolerances.....	4
6.1	Quality tolerances.....	4
6.2	Size tolerances.....	4
6.3	Test methods.....	4
7	Provisions concerning presentation.....	4
7.1	Uniformity.....	4
7.2	Packaging.....	4
7.3	Presentation.....	5
8	Marking or labelling.....	5
8.1	Consumer packages.....	5
8.2	Non-retail containers.....	5
9	Contaminants.....	6
9.1	Heavy metals.....	6
9.2	Pesticide residues.....	6
10	Hygiene.....	7
	Annex A (normative) Determination of the content of pest-infested and spoiled pomegranate, immature fruits, extraneous matter and deviations from the main colour.....	11
	Annex B (normative) Folin-Ciocalteu method for measurement of total phenolics.....	12
	Annex C (informative) Some characteristic compositional data of pomegranate.....	14
	Annex D (informative) Model certificate of conformity with standards for fresh fruits and vegetables.....	15
	Annex E (informative) Pomegranate fruit — Fact sheet.....	16
	Annex F (informative) Pomegranate — Codex, EU and USA pesticide residue limits.....	21

Draft for comments only — Not to be cited as East African Standard

## Pomegranate fruit — Specification and test methods

### 1 Scope

This East African Standard applies to pomegranates of varieties (cultivars) grown from *Punica granatum* L. of *Puniaceae* family to be supplied fresh to the consumer, pomegranates for industrial processing being 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 the Packaging and Transport of Tropical Fresh Fruit and Vegetables*

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

EAS 38, *Labelling of prepackaged foods — Specification*

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

### 3 Definitions

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

#### 3.1

##### **pomegranate**

fruit of the tree *Punica granatum* (L.)

#### 3.2

##### **pest-infested pomegranate**

pomegranate damaged by insect and/or mite infestation

#### 3.3

##### **spoiled pomegranate**

pomegranate damaged by bruises, or darkened in colour, frozen, sun-burnt or showing the presence of visible decomposition caused by bacteria, fungi, visible mould hyphae or any other indications of disease

#### 3.4

##### **immature pomegranate**

pomegranate obtained from an unripe pomegranate having poor flavour, hard tissues and undesirable appearance

#### 3.5

##### **fermented pomegranate**

pomegranate damaged by fermentation to the extent that the characteristic appearance and/or flavour is substantially affected

**3.6**

**extraneous matter**

dirt, pieces of skin, calyx, leaf, peduncle, twigs, bits of wood or any other foreign matter among or on the pomegranate

**4 Provisions concerning quality**

**4.1 General**

The purpose of the standard is to define the quality requirements for pomegranates at the market control stage, after preparation and packaging.

**4.2 Minimum requirements**

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

- (a) fresh in appearance;
- (b) mature and solid in feel;
- (c) clean, free from any visible foreign matter;
- (d) free from pests affecting the general appearance of the produce; Pomegranates shall be free from mites or other parasites and moulds, and shall be practically free from dead insects, insect fragments and rodent contamination visible to the naked eye.
- (e) free of damage caused by pests;
- (f) free of cracking of skin, mechanical injury/rubbing, staining;
- (g) free of abnormal external moisture excluding condensation following removal from cold storage;
- (h) free of any foreign smell or taste; Pomegranates shall have an odour and taste characteristic of the variety. They shall be free from foreign odour and odour traces coming from abnormal fermented pomegranates
- (i) free of any pronounced blemishes;
- (j) sound and clean; pomegranates affected by rotting or deterioration such as to make it unfit for consumption is excluded. Annex C contains some characteristic compositional data.

**4.2.2** Pomegranates must be carefully picked and have reached an appropriate degree of development and ripeness in accordance with criteria proper to the variety and/or commercial type and to the area in which they are grown. The development and condition of the Pomegranate must be such as to enable them:

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

**4.3 Classification**

Pomegranates shall be classified on the basis of colour and the presence of defects, extraneous matter and other features, as specified in Table 1. They may also be separated into sizes.

**4.3.1 Extra Class**

Pomegranates must be of superior quality. They must have the shape, development and colouring that are typical of the variety and/or commercial type. They must be free of defects, with the exception

of very slight superficial defects, provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package.

#### 4.3.2 Class I

Pomegranates must be of good quality. They must be characteristics of the variety and/or commercial type. The following slight defects 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;
- slight skin defects (i.e. scratches, scars, scrapes and blemishes) provided these do not exceed 5% of the total surface area.

#### 4.3.3 Class II

This grade includes Pomegranates which do not qualify for inclusion in the higher grades, but satisfy the minimum requirements. Following defects may be there provided the Pomegranates retain their essential characteristics as regards the quality, the keeping quality and presentation.

- defects in shape,
- defects in colouring,
- skin defects (scratches, scars, scrapes and blemishes) provided these do not exceed 10% of total surface area.

**Table 1 — Requirements for pomegranate classes**

	Extra	Class I	Class II
<b>Pest-infested fruits</b> , max. number of damaged fruits/100 fruits (%)	1	2	3
<b>Spoiled fruits</b> , max. number of spoiled fruits/100 fruits (%)	2	3	4
<b>Immature fruits</b> , max. number of immature fruits/100 fruits (%)	1	2	3
<b>Extraneous matter</b> mass fraction, % (max.)	0.5	1.0	1.5
<b>Colour</b>	light reddish	reddish	brown
<b>Fermented fruits</b> , max. number of fermented fruits/100 fruits (%)	1	2	3
<b>Fruit mass</b> (g)	>480	380 to 480	<380

## 5 Provisions concerning sizing

Size is determined by the weight or maximum diameter of the equatorial section of the fruit, in accordance with the following table:

Size code	Weight in grams (minimum)	Diameter in mm (minimum)
A	400	90
B	350	80
C	300	70
D	250	60
E	200	50

## **6 Provisions concerning tolerances**

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

### **6.1 Quality tolerances**

#### **6.1.1 "Extra" Class**

5% by number or weight of pomegranate not satisfying the requirements for the grade, but meeting those of Class I grade or exceptionally coming within the tolerances of that grade.

#### **6.1.2 Class I**

10% by number or weight of pomegranate not satisfying the requirements of the grade, but meeting those of Class II or, exceptionally coming within the tolerances of that grade.

#### **6.1.3 Class II**

10% by number or weight of pomegranates not satisfying the requirements of the grade, but meeting the minimum requirements.

### **6.2 Size tolerances**

- (i) For all grades, 10% by number or weight of pomegranate corresponding to the size immediately above and/or below than indicated on the package.
- (ii) The maximum size range of 8 mm. between fruit in each package is permitted.

### **6.3 Test methods**

Samples of pomegranates shall be tested for conformity of the product to the requirements of Table 1 by the test method specified in Annex A. The phenolic compounds content shall be tested in accordance with Annex B.

## **7 Provisions concerning presentation**

### **7.1 Uniformity**

The contents of each package must be uniform and contain only pomegranates of the same origin, variety and/or commercial type, quality and size, and appreciably of the same degree of ripeness and development. The visible part of the contents of the package must be representative of the entire contents. In addition, uniformity of colouring is required for "Extra" Class.

### **7.2 Packaging**

Pomegranates must be packed in such a way as to protect the produce properly. The materials used inside the package must be new<sup>1</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.

Pomegranates shall be packed in each container in compliance with CAC/RCP 44.

The containers shall meet the quality, hygiene, ventilation and resistance characteristics to ensure suitable handling, shipping and preserving of the pomegranates. Packages must be free of all foreign matter and smell.

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<sup>1</sup> For the purposes of this Standard, this includes recycled material of food-grade quality.

### 7.3 Presentation

The pomegranates may be presented as follows:

- (a) Arranged in regular layers in the package. This form of presentation is mandatory for "Extra" Class and optional for Classes I and II;
- (b) Not arranged in packages. This type of presentation is only allowed for Class I and II;
- (c) For direct consumption, small consumer packages may be used. The quantities packed in such packages are usually 1.0 kg, 2.0 kg or 5 kg net mass but, if required, other quantities may be used. A suitable number of such small packages shall be placed in large wooden or cardboard cases.

The size of the packages and the number of small packages packed in a case shall be subject to agreement between the purchaser and vendor.

However, the mass of the large containers or cases shall not be more than 15 kg.

## 8 Marking or labelling

### 8.1 Consumer packages

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

#### 8.1.1 Nature of produce

If the produce is not visible from the outside, each package (or lot for produce presented in bulk) shall be labelled as to the name of the produce and may be labelled as to the name of the variety and/or commercial type.

#### 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

Name and address of exporter, packer and/or dispatcher. Identification code (optional).<sup>2</sup>

##### 8.2.2 Nature of produce

Name of the produce if the contents are not visible from the outside. Name of the variety and/or commercial type (optional).<sup>3</sup>

##### 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 and variety;

<sup>2</sup> 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.

<sup>3</sup> The national legislation of a number of countries requires the explicit declaration of the variety.

- Size code for fruit presented in accordance with the size scale or the upper and the lower limiting size code in the case of three consecutive sizes of the size scale;
- Size code (or, when fruit packed by count fall under two adjacent codes, size codes or minimum and maximum diameter in mm) and number of fruit, in the case of fruit arranged in layers in the package;
- If appropriate, a statement indicating the use of preservatives;
- Net weight (optional).

### 8.2.5 Official Inspection Mark (optional)

## 9 Contaminants

### 9.1 Heavy metals

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

Metal	Unit of measurement	Maximum limit	Test method
Lead (Pb)	mg/kg wet weight	0.20	ISO 6633 (AAS)
Cadmium (Cd)	mg/kg wet weight	0.050	ISO 6561-1 or 6561-2
Iron (Fe)	mg/kg wet weight	15.0	EAS 41
Arsenic (As)	mg/kg wet weight	0.2	EAS 41
Copper (Cu)	mg/kg wet weight	5.0	EAS 41
Zinc (Zn)	mg/kg wet weight	5.0	EAS 41

### 9.2 Pesticide residues

Pomegranates shall comply with those maximum pesticide residue limits established by the Codex Alimentarius Commission for this commodity. The limits listed below were current as of the dates indicated. 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 pomegranates (current as at 2009-06-09)

Type	Unit symbol	Limit	Method of test	Notes
2,4-D	MRL (mg/kg) (*)	0.01		
ALDRIN AND DIELDRIN	EMRL (mg/kg)	0.05		
AMITRAZ	MRL (mg/kg)	0.5		
AMITROLE	MRL (mg/kg) (*)	0.05		
BIFENAZATE	MRL (undef)	0.7		
BITERTANOL	MRL (mg/kg)	2		
BROMOPROPYLATE	MRL (mg/kg)	2		
CAPTAN	MRL (undef)	15		
CARBENDAZIM	MRL (mg/kg)	3		Source of data: benomyl, carbendazim, thiophanate-methyl. Based on benomyl use.
CHLORPYRIFOS	MRL (undef)	1		
CLOFENTEZINE	MRL (mg/kg)	0.5		
CYHALOTHRIN	MRL (mg/kg)	0.2		Used also as veterinary drug
CYPERMETHRIN	MRL (mg/kg)	2		
DIAZINON	MRL (mg/kg)	0.3		
DIFENOCONAZOLE	MRL (mg/kg)	0.5		
DIFLUBENZURON	MRL (mg/kg)	5		
DITHIANON	MRL (mg/kg)	5		
DITHIOCARBAMATES	MRL (undef)	5		Source of data: except propineb
DODINE	MRL (mg/kg)	5		
ETOFENPROX	MRL (mg/kg)	1		
FENARIMOL	MRL (mg/kg)	0.3		
FENBUCONAZOLE	MRL (mg/kg)	0.1		

FENBUTATIN OXIDE	MRL (mg/kg)	5		
FENPROPATHRIN	MRL (mg/kg)	5		
FENVALERATE	MRL (mg/kg)	2		
FLUDIOXONIL	MRL (undef)	5		
FLUSILAZOLE	MRL (mg/kg)	0.2		
GLUFOSINATE-AMMONIUM	MRL (mg/kg) (*)	0.05		
HALOXYFOP	MRL (mg/kg) (*)	0.05		
IMAZALIL	MRL (mg/kg)	5		
IPRODIONE	MRL (mg/kg)	5		
KRESOXIM-METHYL	MRL (mg/kg)	0.2		
METALAXYL	MRL (mg/kg) P	1		
METHOXYFENOZIDE	MRL (undef)	2		
MYCLOBUTANIL	MRL (mg/kg)	0.5		
NOVALURON	MRL (undef)	3		
PARAQUAT	MRL (undef) (*)	0.01		
PENCONAZOLE	MRL (mg/kg)	0.2		
PERMETHRIN	MRL (mg/kg)	2		
PHOSALONE	MRL (mg/kg)	2		
PIRIMICARB	MRL (undef)	1		
PYRIMETHANIL	MRL (mg/kg)	7		
TEBUCONAZOLE	MRL (mg/kg)	0.5		
TEBUFENOZIDE	MRL (mg/kg)	1		
TEFLUBENZURON	MRL (mg/kg)	1		
THIABENDAZOLE	MRL (mg/kg) Po	3		Used also as veterinary drug
THIACLOPRID	MRL (mg/kg)	0.7		
TOLYLFLUANID	MRL (mg/kg)	5		
TRIFLOXYSTROBIN	MRL (undef)	0.7		Interim MRL (2005-2009)
VINCLOZOLIN	MRL (mg/kg)	1		

## 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.

**10.3** The product

- a) shall be free from microorganisms in amounts which may represent a hazard to health;
- b) shall be free from parasites which may represent a hazard to health, such as
  - 1) total mesophilic aerobic bacteria  $1 \times 10^5$  cfu/g max.,
  - 2) *Escherichia coli* 0 cfu/g max.,
  - 3) mould-yeast  $1 \times 10^3$  cfu/g max.,
  - 4) *Salmonella* 0 cfu per 25 g max.,
  - 5) *Staphylococcus aureus* 0 cfu/g max.



Fresh pomegranate



Open fruit



Pomegranate flower



Fresh pomegranate on tree

Draft for comments only

Standard



Pomegranate tree with fruit

Draft for comment

Standard



Pomegranate tree with fruit

Draft for comments only

an Standard

## Annex A (normative)

### Determination of the content of pest-infested and spoiled pomegranate, immature fruits, extraneous matter and deviations from the main colour

#### A.1 Principle

A test portion of pomegranate fruits is visually inspected by physical separation of the damaged pieces, immature fruits and extraneous matter from the sound, healthy and ripe pieces of the sample.

#### A.2 Procedure

Weigh to the nearest 0.02 g, a test portion of about 500 g. Separate carefully, by hand or using tweezers, the pest-infested and spoiled pomegranates, immature fruits, extraneous matter and the pomegranates which show deviations from the main colour.

Weigh to the nearest 0.02 g, each of the categories separately.

#### A.3 Calculation

The proportion,  $p$ , expressed as a percentage by mass, of each category separately is equal to

$$p = \frac{m_1}{m_0} \times 100 \%$$

where

$m_0$  is the mass, in grams, of the test portion;

$m_1$  is the mass, in grams, of the relevant category (see A.2).

#### A.4 Test report

The test report shall specify:

- all information necessary for the complete identification of the sample;
- the sampling method used, if known;
- the test method used, with reference to this International Standard;
- all operating details not specified in this Standard, or regarded as optional, together with details of any incidents which may have influenced the test result(s);
- the test result(s) obtained, or, if the repeatability has been checked, the final quoted result obtained.

**Annex B**  
(normative)**Folin-Ciocalteu method for measurement of total phenolics****B.1 Principle**

This procedure is based on the quantitative analysis of phenolic compounds by phenol reagent.

**B.2 Reagent**

Use only reagents of recognized analytical grade and distilled or demineralized water or water of equivalent purity.

**B.2.1 Folin-Ciocalteu phenol reagent**, commercially available, ready prepared.

Before analysis, Folin-Ciocalteu phenol reagent should be diluted to 1:10 by using distilled water. Discard any unused diluted reagent.

Store according to manufacturer's recommendations, and ensure that the reagent is protected from light.

**B.2.2 Sodium carbonate**, 75 g Na<sub>2</sub>CO<sub>3</sub> diluted to 1 l by using distilled water.

**B.2.3 Standard phenolic compound solutions.**

For preparing the calibration curve, gallic acid or ferulic acid could be used as a standard phenolic compound. Prepare a 500 mg/l gallic acid or ferulic acid stock-solution and dilute it to obtain the following series of working solution: 0.25 mg/l, 50 mg/l, 100 mg/l, 125 mg/l and 250 mg/l.

**B.3 Apparatus**

Usual laboratory apparatus and, in particular, the following.

**B.3.1 UV/VIS spectrophotometer (725 nm).**

**B.3.2 Waring blender.**

**B.4 Procedure****B.4.1 Extraction**

Blend 100 g pomegranate fruit by using the blender (B.3.2).

Weigh 10 g and make to volume with distilled water into 100 ml and mix.

Filter through filter paper.

**B.4.2 Absorbance determination**

Add 0.2 ml pomegranate extract and 1.15 ml distilled water and then 0.15 ml Folin-Ciocalteu phenol reagent. Mix well and let the mixture sit at room temperature for 5 min. Add 1.5 ml sodium carbonate solution (B.2.2) and mix well. Let the mixture sit at room temperature for 90 min and read the absorbance at 725 nm by using UV/VIS spectrophotometer (B.3.1).

**B.4.3 Calculation**

Calculate the amount of phenolic compounds,  $m_{t,p}$  by using the following formula:

$$m_{t,p} = \frac{(20.9 \times A)}{100} \times f \times \frac{V_e}{V_a} \times \frac{100}{m_s}$$

where

$m_{t,p}$  is the mass, in milligrams, of the total phenolic per 100 g gallic acid or ferulic acid;

$A$  is the absorbance (abs. at 725 nm);

$f$  is the dilution factor, in millilitres;

$V_e$  is the extract volume, in millilitres;

$V_a$  is the assay volume, in millilitres;

$m_s$  is the mass of the sample in grams.

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**Annex C**  
(informative)

**Some characteristic compositional data of pomegranate**

	Variation limits		
	min.	max.	mean
Relative density (20/20 °C)	1,054	1,074	1,068
Soluble solid (mass fraction, %)	12,6	18,70	15,80
Titrateable acidity (g/l)	1,9	58,40	10,34
pH Value	2,4	4,41	3,18
Protein (N x 6,25) (mass fraction, %)	0,106	0,422	0,184
Total phenolic compounds (mg/l)	575	1972	1303
Prolin (mg/l)	1	23	7,6
Ash (g/l)	1,88	6,11	3,64
<b>ORGANIC ACIDS</b>			
Citric acid (g/l)	0,28	32,8	6,88
L-Malic acid (g/l)	0,0	2,83	0,72
D-Isocitric acid (g/l)	13,9	186	54,92
<b>SUGARS</b>			
Reducing sugars (g/l)	110,4	194,2	143,6
Sucrose (g/l)	0	0	0
Glucose (g/l)	47,1	82,7	61,03
Fructose (g/l)	41,8	97,8	63,56
<b>VITAMINS</b>			
Thiamin (mg/kg)	39,4	86,9	57,85
Riboflavin (mg/kg)	1,21	8,47	3,71
Ascorbic acid (mg/kg)	40	246	117
<b>MINERALS</b>			
Potassium (K) (mg/kg)	809	2251	1439
Calcium (Ca) (mg/kg)	61	207	78,5
Sodium (Na) (mg/kg)	4,41	45,8	18,9
Magnesium (Mg) (mg/kg)	18,37	81,5	38,65
Phosphorus (P) (mg/kg)	17	88,1	42,8
Iron (Fe) (mg/kg)	3,75	17,1	6,62
Copper (Cu) (mg/kg)	0,72	3,97	1,81
Zinc (Zn) (mg/kg)	1,4	5,7	2,35
Manganese (Mn) (mg/kg)	0,1	0,79	0,33

**Annex D**  
(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		
6. Identifier of means of transport		4. Place of inspection/country of origin <sup>(1)</sup>	5. Region or 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>CD/K/102:2010, Pomegranate fruits — Specification and grading</u> _____ Customs office foreseen ..... Place and date of issue ..... Valid until (date): ..... Signatory (name in block letters): .....  <div style="display: flex; justify-content: space-around;"> <span>Signature</span> <span>Seal of competent authority</span> </div>			
13. Observations:			
<sup>(1)</sup> Where the goods are being re-exported, indicate the origin in box 9.			

## Annex E (informative)

### Pomegranate fruit — Fact sheet

#### *Punica granatum*



<b>Authority</b>	L.
<b>Family</b>	Magnoliopsida:Rosidae:Myrtales:Punicaceae
<b>Synonyms</b>	
<b>Common names</b>	Pomegranate, Rumman, Roma, Roman, Grenadier, Granada, Grenade, Granatapfel, Anar, grenadine, Chinese apple, roma, roman, romanzeira, milgrada, mirgadeira, granada, granado, dalima, melograno, Darimba, Delima, Julnar, Salebin, Talibin, Totum, Ph'ilaa, Thapthim, Phila, Bakoh, Lu'u, Thap lu'u, Roumamman-gloulnar, Rummani, Ximani, <u>Ngukumaanga</u> , Mbona wesilungu, <u>Mkoma manga</u> .
<b>Editor</b>	
<b>Ecocrop code</b>	1829

#### Description

A deciduous or evergreen shrub or small crooked tree reaching 2-6 m or sometimes up to 10 m in height, often much branched near the base. The leaves are lanceolate. The fruit is a globose berry, 6-12 cm in diameter, with a leathery skin and yellow-green to black-violet in colour.

#### Uses

The fruits are used as a salad or table fruit and in beverages. The fruit skin contains tannin. Dried bark, roots, fruit rind, and seeds have medicinal properties and are also the source of tannin. The fruit rind is also a source of a dye. The tree can be grown as an ornamental.

#### Growing period

Perennial. The plant may begin to fruit 2-4 years from planting and the fruits ripen about 180 days after flowering.

#### Further information

Scientific synonym: *P. nana*. Pomegranate is native of Iran, Afghanistan and the Himalayas. It thrives where winters are cool and summers hot and dry with medium to low humidity, but it requires plenty of water at the root. It can be grown at elevations up to 1600 m. Yields may be about 100-200 kg of fruit per fully developed tree per year, about 50-200 fruits per tree or up to 10 t/ha.

#### Details

Steeped in history and romance and almost in a class by itself, the pomegranate, *Punica granatum* L., belongs to the family Punicaceae which includes only one genus and two species, the other one, little-known, being *P. protopunica* Balf. peculiar to the island of Socotra.

Despite its ancient background, the pomegranate has acquired only a relatively few commonly recognized vernacular names apart from its many regional epithets in India, most of which are variations on the Sanskrit *dadima* or *dalim*, and the Persian *dulim* or *dulima*. By the French it is called *grenade*; by the Spanish, *granada* (the fruit), *granado* (the plant); by the Dutch, *granaatappel*, and by the Germans, *granatapfel*; by the Italians, *melograno*, *melograno granato*, *pomo granato*, or *pomo punico*. In Indonesia, it is *gangsalan*; in Thailand, *tab tim*; and in Malaya, *delima*. Brazilians know it as *roma*, *romeira* or *romazeira*. The Quechua Indian name in Guatemala is *granad*. The Samoan name is

*limoni*. The generic term, *Punica*, was the Roman name for Carthage from whence the best pomegranates came to Italy.

### Description

An attractive shrub or small tree, to 6 or 10 m high, the pomegranate is much-branched, more or less spiny, and extremely long-lived, some specimens at Versailles known to have survived two centuries. It has a strong tendency to sucker from the base. The leaves are evergreen or deciduous, opposite or in whorls of 5 or 6, short-stemmed, oblong-lanceolate, 1-10 cm long, leathery. Showy flowers are borne on the branch tips singly or as many as 5 in a cluster. They are 3 cm wide and characterized by the thick, tubular, red calyx having 5 to 8 fleshy, pointed sepals forming a vase from which emerge the 3 to 7 crinkled, red, white or variegated petals enclosing the numerous stamens. Nearly round, but crowned at the base by the prominent calyx, the fruit, 6.25-12.5 cm wide, has a tough, leathery skin or rind, basically yellow more or less overlaid with light or deep pink or rich red. The interior is separated by membranous walls and white spongy tissue (rag) into compartments packed with transparent sacs filled with tart, flavourful, fleshy, juicy, red, pink or whitish pulp (technically the aril). In each sac, there is one white or red, angular, soft or hard seed. The seeds represent about 52% of the weight of the whole fruit.

### Origin and Distribution

The pomegranate tree is native from Iran to the Himalayas in northern India and has been cultivated since ancient times throughout the Mediterranean region of Asia, Africa and Europe. The fruit was used in many ways as it is today and was featured in Egyptian mythology and art, praised in the Old Testament of the Bible and in the Babylonian Talmud, and it was carried by desert caravans for the sake of its thirst-quenching juice. It traveled to central and southern India from Iran about the first century A.D. and was reported growing in Indonesia in 1416. It has been widely cultivated throughout India and drier parts of southeast Asia, Malaya, the East Indies and tropical Africa. The most important growing regions are Egypt, China, Afghanistan, Pakistan, Bangladesh, Iran, Iraq, India, Burma and Saudi Arabia. There are some commercial orchards in Israel on the coastal plain and in the Jordan Valley.

It is rather commonly planted and has become naturalized in Bermuda where it was first recorded in 1621, but only occasionally seen in the Bahamas, West Indies and warm areas of South and Central America. Many people grow it at cool altitudes in the interior of Honduras. In Mexico it is frequently planted, and it is sometimes found in gardens in Hawaii. The tree was introduced in California by Spanish settlers in 1769. It is grown for its fruit mostly in the dry zones of that state and Arizona. In California, commercial pomegranate cultivation is concentrated in Tulare, Fresno and Kern counties, with small plantings in Imperial and Riverside counties. There were 2,000 acres (810 ha) of bearing trees in these areas in the 1920's. Production declined from lack of demand in the 1930's but new plantings were made when demand increased in the 1960's.

### Cultivars

There is little information available on the types grown in the Near East, except that the cultivars '**Ahmar**', '**Aswad**', '**Halwa**' are important in Iraq, and '**Mangulati**' in Saudi Arabia. '**Wonderful**' and '**Red Loufani**' are often grown in the Jewish sector of Israel, while the sweeter, less tangy '**Malissi**' and '**Ras el Baghi**', are favored in the Arab sector.

In India there are several named cultivars. Preference is usually given those with fleshy, juicy pulp around the seeds. Types with relatively soft seeds are often classed as "seedless". Among the best are '**Bedana**' and '**Kandhari**'. '**Bedana**' is medium to large, with brownish or whitish rind, pulp pinkish-white, sweet, seeds soft. '**Kandhari**' is large, deep-red, with deep-pink or blood-red, subacid pulp and hard seeds. Others include:

'**Alandi**' ('**Vadki**')—medium-sized, with fleshy red or pink, subacid pulp, very hard seeds.

'**Dholka**'—large, yellow-red, with patches of dark-pink and purple at base, or all-over greenish-white; thick rind, fleshy, purplish-white or white, sweet, pulp; hard seeds. The plant is evergreen, non-suckering, desirable for commercial purposes in Delhi.

'**Kabul**'—large, with dark-red and pale-yellow rind; fleshy, dark-red, sweet, slightly bitter pulp.

**'Muscat Red'**—small to medium, with thin or fairly thick rind, fleshy, juicy, medium-sweet pulp, soft or medium-hard seeds. The plant is a moderately prolific bearer.

**'Paper Shell'**—round, medium to large, pale-yellow blushed with pink; with very thin rind, fleshy, reddish or pink, sweet, very juicy pulp and soft seeds. Bears heavily.

**'Poona'**—large, with dark-red, gray or grayish-green rind, sometimes spotted, and orange-red or pink-and-red pulp.

**'Spanish Ruby'**—round, small to medium or large; bright-red, with thin rind, fleshy, rose-colored, sweet, aromatic pulp, and small to medium, fairly soft seeds. Considered medium in quality.

**'Vellodu'**—medium to large, with medium-thick rind, fleshy, juicy pulp and medium-hard seeds.

**'Muscat White'**—large, creamy-white tinged with pink; thin rind; fleshy, cream-colored, sweet pulp; seeds medium-hard. Bears well. Desirable for commercial planting in Delhi.

**'Wonderful'**—originated as a cutting in Florida and propagated in California in 1896. The fruit is oblate, very large, dark purple-red, with medium-thick rind; deep-red, juicy, winey pulp; medium-hard seeds. Plant is vigorous and productive.

In California, 'Spanish Ruby' and 'Sweet Fruited' were the leading cultivars in the past century, but were superseded by 'Wonderful'. In recent years 'Wonderful' is losing ground to the more colorful 'Grenada'.

Mexicans take especial pride in the pomegranates of Tehuacan, Puebla. Many cultivars are grown, including **'Granada de China'** and **'Granada Agria'**.

The Japanese dwarf pomegranate, *P. granatum* var. *nana*, is especially hardy and widely grown as an ornamental in pots. The flowers are scarlet, the fruit only 2 in (5 cm) wide but borne abundantly. Among other ornamental cultivars are **'Multiplex'** with double, creamy white blooms; **'Chico'**, double, orange-red; **'Pleniflora'**, double, red; **'Rubra Plena'**, double, red; **'Mme. Legrelle'** and **'Variegata'**, double, scarlet bordered and streaked with yellowish-white.

#### **Pollination**

The pomegranate is both self-pollinated and cross-pollinated by insects. There is very little wind dispersal of pollen. Self-pollination of bagged flowers has resulted in 45% fruit set. Cross-pollination has increased yield to 68%. In hermaphrodite flowers, 6 to 20% of the pollen may be infertile; in male, 14 to 28%. The size and fertility of the pollen vary with the cultivar and season.

#### **Climate**

The species is primarily mild-temperate to subtropical and naturally adapted to regions with cool winters and hot summers, but certain types are grown in home dooryards in tropical areas, such as various islands of the Bahamas and West Indies. In southern Florida, fruit development is enhanced after a cold winter. Elsewhere in the United States, the pomegranate can be grown outdoors as far north as Washington County, Utah, and Washington, D.C., though it doesn't fruit in the latter locations. It can be severely injured by temperatures below 12° F (-11.11° C). The plant favors a semi-arid climate and is extremely drought-tolerant.

#### **Soil**

The pomegranate thrives on calcareous, alkaline soil and on deep, acidic loam and a wide range of soils in between these extremes. In northern India, it is spontaneous on rockstrewn gravel.

#### **Propagation**

Pomegranate seeds germinate readily even when merely thrown onto the surface of loose soil and the seedlings spring up with vigor. However, to avoid seedling variation, selected cultivars are usually reproduced by means of hardwood cuttings 10 to 20 in (25-50 cm) long. Treatment with 50 ppm. indole-butyric acid and planting at a moisture level of 15.95% greatly enhances root development and

survival. The cuttings are set in beds with 1 or 2 buds above the soil for 1 year, and then transplanted to the field. Grafting has never been successful but branches may be air-layered and suckers from a parent plant can be taken up and transplanted.

### Culture

Rooted cuttings or seedlings are set out in pre-fertilized pits 2 ft (60 cm) deep and wide and are spaced 12 to 18 ft (3.5-5.5 m) apart, depending on the fertility of the soil. Initially, the plants are cut back to 24 to 30 in (60-75 cm) in height and after they branch out the lower branches are pruned to provide a clear main stem. Inasmuch as fruits are borne only at the tips of new growth, it is recommended that, for the first 3 years, the branches be judiciously shortened annually to encourage the maximum number of new shoots on all sides, prevent straggly development, and achieve a strong, well-framed plant. After the 3rd year, only suckers and dead branches are removed.

For good fruit production, the plant must be irrigated. In Israel, brackish water is utilized with no adverse effect. In California, irrigation water is supplied by overhead sprinklers which also provide frost protection during cold spells. The pomegranate may begin to bear in 1 year after planting out, but 2 1/2 to 3 years is more common.

### Harvesting and Yield

The fruits ripen 6 to 7 months after flowering. In Israel, cultivar 'Wonderful' is deemed ready for harvest when the soluble solids (SSC) reach 15%. In California, maturity has been equated with 1.8% titratable acidity (TA) and SSC of 17% or more. The fruit cannot be ripened off the tree even with ethylene treatment. Growers generally consider the fruit ready for harvest if it makes a metallic sound when tapped. The fruit must be picked before over maturity when it tends to crack open if rained upon or under certain conditions of atmospheric humidity, dehydration by winds, or insufficient irrigation. Of course, one might assume that ultimate splitting is the natural means of seed release and dispersal.

The fruits should not be pulled off but clipped close to the base so as to leave no stem to cause damage in handling and shipping. Appearance is important, especially in the United States where pomegranates may be purchased primarily to enhance table arrangements and other fall (harvest-time) decorations. Too much sun exposure causes sunscald—brown, russeted blemishes and roughening of the rind.

The fruit ships well, cushioned with paper or straw, in wooden crates or, for nearby markets, in baskets. Commercial California growers grade the fruits into 8 sizes, pack in layers, unwrapped but topped with shredded plastic, in covered wood boxes, precool rapidly, and ship in refrigerated trucks.

### Keeping Quality and Storage

The pomegranate is equal to the apple in having a long storage life. It is best maintained at a temperature of 32° to 41° F (0°-5° C). The fruits improve in storage, become juicier and more flavorful; may be kept for a period of 7 months within this temperature range and at 80 to 85% relative humidity, without shrinking or spoiling. At 95% relative humidity, the fruit can be kept only 2 months at 41° F (5° C); for longer periods at 50° F (10° C). After prolonged storage, internal breakdown is evidenced by faded, streaky pulp of flat flavor. 'Wonderful' pomegranates, stored in Israel for Christmas shipment to Europe, are subject to superficial browning ("husk scald"). Control has been achieved by delaying harvest and storing in 2% O<sub>2</sub> at 35.6° F (2° C). Subsequent transfer to 68° F (20° C) dispels off-flavor from ethanol accumulation.

### Pests and Diseases

The pomegranate butterfly, *Virachola isocrates*, lays eggs on flower-buds and the calyx of developing fruits; in a few days the caterpillars enter the fruit by way of the calyx. These fruit borers may cause loss of an entire crop unless the flowers are sprayed 2 times 30 days apart. A stem borer sometimes makes holes right through the branches. Twig dieback may be caused by either *Pleuroplaconema* or *Ceuthospora Phyllosticta*. Discoloration of fruits and seeds results from infestation by *Aspergillus castaneus*. The fruits may be sometimes disfigured by *Sphaceloma punicae*. Dry rot from *Phomopsis* sp. or *Zythia versoniana* may destroy as much as 80% of the crop unless these organisms are controlled by appropriate spraying measures. Excessive rain during the ripening season may induce soft rot. A post-harvest rot caused by *Alternaria solani* was observed in India in 1974. It is particularly prevalent in cracked fruits.

Minor problems are leaf and fruit spot caused by *Cercospora*, *Gloeosporium* and *Pestalotia* sp.; also foliar damage by whitefly, thrips, mealybugs and scale insects; and defoliation by *Euproctis* spp. and *Archyophora dentula*. Termites may infest the trunk. In India, paper or plastic bags or other covers may be put over the fruits to protect them from borers, birds, bats and squirrels.

#### Food Uses

For enjoying out-of-hand or at the table, the **fruit** is deeply scored several times vertically and then broken apart; then the clusters of juice sacs can be lifted out of the rind and eaten. Italians and other pomegranate fanciers consider this not a laborious handicap but a social, family or group activity, prolonging the pleasure of dining.

In some countries, such as Iran, the **juice** is a very popular beverage. Most simply, the juice sacs are removed from the fruit and put through a basket press. Otherwise, the fruits are quartered and crushed, or the whole fruits may be pressed and the juice strained out. In Iran, the cut-open fruits may be stomped by a person wearing special shoes in a clay tub and the juice runs through outlets into clay troughs. Hydraulic extraction of juice should be at a pressure of less than 100 psi to avoid undue yield of tannin. The juice from crushed whole fruits contains excess tannin from the rind (as much as 0.175%) and this is precipitated out by a gelatin process. After filtering, the juice may be preserved by adding sodium benzoate or it may be pasteurized for 30 minutes, allowed to settle for 2 days, then strained and bottled. For beverage purposes, it is usually sweetened. Housewives in South Carolina make pomegranate jelly by adding 7 1/2 cups of sugar and 1 bottle of liquid pectin for every 4 cups of juice. In Saudi Arabia, the juice sacs may be frozen intact or the extracted juice may be concentrated and frozen, for future use. Pomegranate juice is widely made into grenadine for use in mixed drinks. In the Asiatic countries it may be made into a thick sirup for use as a sauce. It is also often converted into wine.

In the home kitchen, the juice can be easily extracted by reaming the halved fruits on an ordinary orange-juice squeezer.

In northern India, a major use of the wild fruits is for the preparation of "anardana"—the juice sacs being dried in the sun for 10 to 15 days and then sold as a spice.

#### Toxicity

A tannin content of no more than 0.25% in the edible portion is the desideratum. Many studies have shown that tannin is carcinogenic and excessive ingestion of tannin from one or more sources, over a prolonged period, is detrimental to health. (See also "Medicinal Uses" regarding overdoses of bark.)

#### Other Uses

All parts of the tree have been utilized as sources of tannin for curing leather. The **trunk bark** contains 10 to 25% tannin and was formerly important in the production of Morocco leather. The **root bark** has a 28% tannin content, the leaves, 11%, and the fruit rind as much as 26%. The latter is a by-product of the "anardana" industry. Both the **rind** and the **flowers** yield dyes for textiles. Ink can be made by steeping the **leaves** in vinegar. In Japan, an insecticide is derived from the bark. The pale-yellow **wood** is very hard and, while available only in small dimensions, is used for walking-sticks and in woodcrafts.

**Medicinal Uses:** The juice of wild pomegranates yields citric acid and sodium citrate for pharmaceutical purposes. Pomegranate juice enters into preparations for treating dyspepsia and is considered beneficial in leprosy.

The bark of the stem and root contains several alkaloids including isopelletierine which is active against tapeworms. Either a decoction of the bark, which is very bitter, or the safer, insoluble Pelletierine Tannate may be employed. Overdoses are emetic and purgative, produce dilation of pupila, dimness of sight, muscular weakness and paralysis.

Because of their tannin content, extracts of the bark, leaves, immature fruit and fruit rind have been given as astringents to halt diarrhea, dysentery and hemorrhages. Dried, pulverized flower buds are employed as a remedy for bronchitis. In Mexico, a decoction of the flowers is gargled to relieve oral and throat inflammation. Leaves, seeds, roots and bark have displayed hypotensive, antispasmodic and anthelmintic activity in bioassay.

## Annex F (informative)

### Pomegranate — 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>Carfentrazone-ethyl</b>	0.1	---	<i>{0.01}</i>
	1. European Union does not maintain a specific MRL for the Carfentrazone-ethyl/Pomegranate combination, but does maintain an MRL of 0.01 PPM for its "Fruit Fresh or Frozen; Nuts" group.		
	US	Cod	EU 2
<b>Fenhexamid</b>	2	---	<i>{0.05}</i>
	2. European Union does not maintain a specific MRL for the Fenhexamid/Pomegranate combination, but does maintain an MRL of 0.05 PPM for its "Inedible peel, large" group.		
	US	Cod	EU
<b>Fludioxonil</b>	5	---	<i>{3}</i>
	US	Cod	EU 3
<b>Glyphosate</b>	0.2	---	<i>{0.1}</i>
	3. European Union does not maintain a specific MRL for the Glyphosate/Pomegranate combination, but does maintain an MRL of 0.1 PPM for its "Inedible peel, large" group.		
	US	Cod	EU
<b>Imidacloprid</b>	0.9	---	<i>{0.05}</i>
	US	Cod 4	EU
<b>Inorganic bromide resulting from fumigation</b>	100	<i>{20}</i>	<i>{50}</i>
	4. Codex does not maintain a specific MRL for the Inorganic bromide resulting from fumigation/Pomegranate combination, but does maintain an MRL of 20 PPM for its "Fruits (except as otherwise listed)" group.		
	US	Cod	EU 5
<b>Methomyl</b>	0.2	---	<i>{0.05}</i>
	5. Methomyl and Thiodicarb (sum of methomyl and thiodicarb expressed as methomyl) European Union does not maintain a specific MRL for the Methomyl/Pomegranate combination, but does maintain an MRL of 0.05 PPM for its "Miscellaneous fruit" group.		
	US	Cod	EU 6
<b>Oryzalin</b>	0.05	---	<i>{0.01}</i>
	6. European Union does not maintain a specific MRL for the Oryzalin/Pomegranate combination, but does maintain an MRL of 0.01 PPM for its "Miscellaneous fruit" group.		
	US	Cod	EU 7
<b>Oxyfluorfen</b>	0.05	---	0.05
	7. European Union does not maintain a specific MRL for the Oxyfluorfen/Pomegranate combination, but does maintain an MRL of 0.05 PPM for its "Inedible peel, large" group.		
	US	Cod	EU 8
<b>Pendimethalin</b>	0.1	---	<i>{0.05}</i>
	8. European Union does not maintain a specific MRL for the Pendimethalin/Pomegranate combination, but does maintain an MRL of 0.05 PPM for its "Fruit Fresh or Frozen; Nuts" group.		
	US	Cod	EU 9
<b>Pyriproxyfen</b>	0.2	---	<i>{0.05}</i>
	9. European Union does not maintain a specific MRL for the Pyriproxyfen/Pomegranate combination, but does maintain an MRL of 0.05 PPM for its "Miscellaneous fruit" group.		

*Draft for comments only — Not to be cited as East African Standard*

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