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## EAST AFRICAN STANDARD

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Fresh Creole onions — Specification and grading



EAST AFRICAN COMMUNITY

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HS 0703.10.00

## 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

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

*United States Standards for Grades of Creole Onions*, Effective April 10, 1943 (Reprinted — January 1997)

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.

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## Fresh creole onions — Specification and grading

### 1 Scope

This standard applies to Creole onions of varieties (cultivars) grown from *Allium cepa* L. to be supplied to the consumer in the natural state, green onions with full leaves and onions 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

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

the onions have the general distinguishing features of the Creole type, i.e., flat to somewhat globular shape. Variations in colour from yellow to brownish red shall be permitted but white Creole onions shall not be mixed in the same container with onions of other colours.

#### 3.2

##### **mature**

having reached a stage of development at which the onions are firm, not becoming soft or spongy

#### 3.3

##### **fairly well shaped**

having the characteristic shape, not thicknecked, lopsided or otherwise materially deformed, but not necessarily of either flat or globe type

#### 3.4

##### **soft rot**

any soft or mushy condition of the tissue such as bacterial soft rot, or wet breakdown following sunscald

#### 3.5

##### **doubles**

onions which have developed more than one distinct bulb joined only at the base

**3.6**

**bottlenecks**

onions which have thick necks, usually with poorly developed bulbs

**3.7**

**badly misshapen**

the onion is so decidedly deformed that its appearance is seriously affected

**3.8**

**damage**

any specific defect described in this section; or an equally objectionable variation of any one of these defects, any other defect, or any combination of defects, which materially detracts from the appearance, or the edible or marketing quality of the onion. The following specific defects shall be considered as damage:

- (a) **Splits.** A split is an onion which has more than one distinct bulb at least partially covered by an outer scale. Such an onion, if not well cured, shall be considered damaged when not completely covered by more than one outer scale. If well cured, such an onion shall not be regarded as damaged if practically covered by an outer scale, unless the distinct bulbs are readily apparent upon casual examination of the onion.
- (b) **Seedstems** when any Seedstem is tough or woody, or is more than one-fourth inch in diameter.
- (c) **Sunburn.** Sunburn means discoloration due to exposure to the sun where there is no injury to the tissue. Individual onions showing bad sunburn shall be considered as damaged but onions showing slight sunburn shall not be regarded as damaged unless present in a sufficient amount to cause the lot to have a distinctly greenish cast. Onions should not be peeled to detect sunburn.
- (d) **Sunscald.** An onion, when not dry and well cured, shall be considered as damaged if it is affected by any sunscald. If dry and well cured, an onion affected by sunscald shall be regarded as damaged except when the affected area is dry and so inconspicuous that the appearance of the onion is not materially injured.
- (e) **Staining.** Any lot of onions which is materially stained shall be considered as damaged. In this connection the number of stained onions permitted, before the lot is considered damaged, will depend upon the degree of staining on individual onions. As a guide, a lot should be considered damaged if the appearance is affected to a greater extent than the presence of 15 percent appreciably stained plus 5 percent badly stained onions. If the lot has 15 percent which are appreciably stained, and 5 percent which are badly stained and most of the remainder of the lot shows staining of a lesser degree, but approaches that which is considered appreciably stained then the lot shall be considered as damaged by staining. If a lot contains slightly more than 20 percent of appreciably stained onions and most of the lot has none or very little staining, it should not be considered as damaged by staining.

**3.9**

**serious damage**

any specific defect described in this section; or an equally objectionable variation of any one of these defects, any other defect, or any combination of defects, which seriously detracts from the appearance or the edible or marketing quality of the onion. The following specific defects shall be considered as serious damage:

- (a) **Dirt or staining** when more than 10 % of the onions in any lot are badly caked with dirt or are badly stained.
- (b) **Seedstems** when any Seedstem is tough or woody, or is more than 12.7 mm in diameter.

**3.10**

**diameter**

the greatest dimension at right angles to a straight line running from stem to root

## 4 Provisions concerning quality

### 4.1 General

The purpose of the standard is to define the quality requirements of onions at the export 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 bulbs must be:

- (a) intact;
- (b) sound; produce affected by rotting or deterioration such as to make it unfit for consumption is excluded
- (c) clean, practically free of any visible foreign matter
- (d) free from damage due to frost
- (e) sufficiently dry for the intended use
- (f) without hollow or tough stems
- (g) practically free from pests
- (h) practically free from damages caused by pests
- (i) free of abnormal external moisture
- (j) free of any foreign smell and/or taste

**4.2.2** The development and condition of the onions 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

The onions are classified in two classes defined below:

#### 4.3.1 Class I

Onions in this class consists of Creole onions of good quality and similar varietal characteristics which are mature, fairly well shaped, free from soft rot, doubles, bottlenecks, and from damage caused by splits, seedstems, tops, roots, moisture, sunburn, sunscald, cuts, staining, dirt or other foreign matter, diseases, insects, or mechanical or other means.

The bulbs must be:

- firm and compact
- unsprouted (free from externally visible shoots)
- free from swelling caused by abnormal vegetative development

- practically free of root tufts; however, for onions harvested before complete maturity, root tufts are allowed.

The following defects, however, may be allowed, provided they do not affect the general appearance of the produce, the quality, the keeping quality or presentation in the package:

- a slight defect in shape
- a slight defect in colouring
- light staining which does not affect the last dried skin protecting the flesh, provided it does not cover more than one fifth of the bulb's surface
- superficial cracks in, and partial absence of the outer skins, provided the flesh is protected.

#### **4.3.2 Class II**

Onions in this class consists of Creole onions of similar varietal characteristics which are not badly misshapen and are free from soft rot, doubles, bottlenecks, and from damage caused by splits, moisture, sunscald, and from serious damage caused by Seedstems, tops, roots, cuts, staining, dirt or other foreign matter, diseases, insects, or mechanical or other means.

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

- defect in shape
- defect in colouring
- early evidence of externally visible shoot growth (no more than 10 per cent by number or weight by unit of presentation)
- traces due to rubbing
- slight marking caused by parasites or disease
- small healed cracks
- slight bruising, healed, unlikely to impair keeping qualities
- root tufts
- stains which do not affect the last dried skin protecting the flesh, provided they do not cover more than half the bulb's surface
- cracks in the outer skins and partial absence of over a maximum of one third of the bulb's surface, provided the flesh is not damaged.

#### **4.3.3 Combination class**

Any lot of Creole onions may be designated "Combination" when not less than 50 percent, by weight, of the onions in each container meet the requirements of Class I and the remainder Class II.

#### **4.3.4 Unclassified**

"Unclassified" consists of onions which have not been classified in accordance with any of the foregoing grades. The term "unclassified" is not a grade within the meaning of this standard but is provided as a designation to show that no grade has been applied to the lot.

## 5 Provisions concerning sizing

Unless otherwise specified, onions in Class I shall have a minimum size of 4.2 cm in diameter while those in Class II shall have a minimum of 3.8 cm in diameter.

## 6 Provisions concerning tolerances

In order to allow for variations incident to proper grading and handling in each of the foregoing grades, the following tolerances, by weight, are provided as specified:

### 6.1 Quality tolerances

#### 6.1.1 Class I and Class II

Ten percent for onions in any lot which fail to meet the requirements of the specified grade, including therein not more than 2 percent for onions which are watersoaked or affected by soft rot.

#### 6.1.2 Combination Class

Ten percent for onions in any lot which fail to meet the requirements of Class II grade, including therein not more than 2 percent for onions which are watersoaked or affected by soft rot. No part of any tolerance shall be allowed to reduce for the lot as a whole the percentage of Class I onions required in the combination, but individual containers may have not more than a total of 15 percentage points less than the percentage of Class I onions required provided that the entire lot averages within the percentage required.

### 6.2 Size tolerances

Five percent for onions in any lot which are below the specified minimum size and 15 percent for onions which are larger than any specified maximum size.

### 6.3 Application of tolerances

The contents of individual packages in the lot are subject to the following limitations:

- (a) For a tolerance of 10 percent or more, not more than one-tenth of the packages in any lot may contain more than one and one-half times the tolerance specified: Provided, That soft rot in any package shall not exceed three times the tolerance: And provided further, That the average for the entire lot is within the tolerance specified for the grade.
- (b) For a tolerance of less than 10 percent, not more than one-tenth of the packages in any lot may contain more than double the tolerance specified: Provided, That soft rot in any package shall not exceed three times the tolerance and that at least one defective and one off-size specimen may be permitted in any package: And provided further, That the average for the entire lot is within the tolerance specified for the grade.

## 7 Provisions concerning presentation

### 7.1 Uniformity

The contents of each package (or lot, for produce presented in bulk) must be uniform and contain only Creole onions of the same origin, variety, quality and size.

However, sales packages, of a net weight not exceeding three kilogrammes, may contain mixtures of onions of different colours, provided that they are uniform in quality, and, for each colour concerned, in origin, variety and size.

The visible part of the contents of the package (or lot, for produce presented in bulk) must be representative of the entire contents.

## **7.2 Packaging**

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

The materials used inside the package must be new, clean and of a quality such as to avoid causing any external or internal damage to the produce. The use of materials, and in particular of paper or stamps bearing trade specifications is allowed, provided the printing or labelling is 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.

Packages must be free of all foreign matter.

## **7.3 Presentation**

Creole onions may be presented:

- arranged in layers
- loose in a package (including bulk bins)
- transported in bulk
- in strings
- either of a certain number of bulbs, in which case the strings must contain at least six onions (with fully dried stems)
- or of a certain net weight.

## **8 Marking and 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 shall be labelled as to the name of the produce and may be labelled as to name of the variety and/or commercial type.

### **8.2 Non-retail containers**

Each package<sup>1</sup> must bear the following particulars in letters grouped on the same side, legibly and indelibly marked, and visible from the outside:

For Creole onions transported in bulk (direct loading into a transport vehicle) these particulars must appear on a document accompanying the goods, and attached in a visible position inside the transport vehicle.

#### **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

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<sup>1</sup> Package units of produce prepacked for direct sale to the consumer shall not be subject to these marking provisions but shall conform to the national requirements. However, the markings referred to shall in any event be shown on the transport packaging containing such package units.

officially recognized by the national authority.<sup>2</sup>

### 8.2.2 Nature of produce

- "Creole onions" if the contents are not visible from the outside.
- In the case of sales packages containing a mixture of different colours of Creole onions:
  - 'Mixed Creole onions' or equivalent denomination,
- If the contents are not visible from the outside, the indication of each of the colours present in the package and of the minimum number of pieces of each of the colours concerned.

### 8.2.3 Origin of produce

- Country of origin and, optionally, national, regional or local place name.
- In the case of sales packages containing a mixture of Creole onions of different colours and different origins, the indication of each country of origin shall appear next to the name of the colour concerned.

### 8.2.4 Commercial specifications

- Class
- Size expressed by minimum and maximum diameters
- Net weight.

### 8.2.5 Official control mark (optional)

## 9 Contaminants

### 9.1 Pesticide residues

Fresh Creole onions 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 fresh Creole onions (current as at 2009-06-07)**

Type	Unit symbol	Limit	Method of test	Notes
ALDICARB	MRL (mg/kg)	0.1		
BENALAXYL	MRL (mg/kg)	0.2		
BENTAZONE	MRL (undef)	0.1		
CHLOROTHALONIL	MRL (mg/kg)	0.5		
CHLORPYRIFOS	MRL (undef)	0.2		
CLETHODIM	MRL (mg/kg)	0.5		
CYPERMETHRIN	MRL (mg/kg)	0.1		
CYPRODINIL	MRL (undef)	0.3		
CYROMAZINE	MRL (mg/kg)	0.1		
DELTA METHRIN	MRL (mg/kg)	0.05		Used also as veterinary drug
DIAZINON	MRL (mg/kg)	0.05		
DICHOFLUANID	MRL (mg/kg)	0.1		

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.

DICLORAN	MRL (mg/kg)	0.2		
DIMETHENAMID-P	MRL (undef) (*)	0.01		
DITHIOCARBAMATES	MRL (undef)	0.5		Source of data: mancozeb
FLUDIOXONIL	MRL (undef)	0.5		Interim MRL (2005-2009)
FOLPET	MRL (undef)	1		
GLUFOSINATE-AMMONIUM	MRL (mg/kg)	0.05		
IMIDACLOPRID	MRL (mg/kg)	0.1		
IPRODIONE	MRL (mg/kg)	0.2		
MALATHION	MRL (undef)	1		
MALEIC HYDRAZIDE	MRL (mg/kg)	15		
METALAXYL	MRL (mg/kg)	2		
METHIDATHION	MRL (mg/kg)	0.1		
METHIOCARB	MRL (mg/kg)	0.5		
METHOMYL	MRL (mg/kg)	0.2		
PIRIMICARB	MRL (undef)	0.1		
PROCYMIDONE	MRL (mg/kg)	0.2		
PYRACLOSTROBIN	MRL (undef)	0.2		
PYRIMETHANIL	MRL (mg/kg)	0.2		
VINCLOZOLIN	MRL (mg/kg)	1		

## 9.2 Heavy metals

Onions 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	0.10	ISO 6633 (AAS)
Cadmium (Cd)	mg/kg wet weight	0.050	ISO 6561-1 or 6561-2

## 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.



Red Creole Onions

Draft for comments only — Not for

African Standard

**Annex A**  
(informative)

**Guide to cold storage**

**A.1 Scope**

This annex gives recommendations for the storage, with or without the use of artificial refrigeration, of onions intended for long-term conservation and consumption in the fresh state.

**A.2 Limits of application**

This annex provides guidance of a very general nature only. Because of the variability of the product according to the time and place of cultivation, local conditions may make it necessary to define other conditions for harvesting or other physical conditions in the store.

This annex does not apply unreservedly, therefore, to all cultivars in all climates, and it will remain for each specialist to be the judge of any modifications to be made.

Moreover, this annex does not take into account the role played by ecological factors, and wastage during storage is not dealt with.

Subject to the restrictions arising from the fact that onions are living material, the application of the guidelines contained in this annex should enable much wastage in storage to be avoided and thus should enable long-term storage to be achieved in most cases.

**A.3 Conditions of harvesting and putting into store**

**A.3.1 Cultivars**

It is necessary to choose onions of cultivars recognized as being well suited for keeping.

NOTE 1 Onions of late cultivars are generally chosen.

**A.3.2 Harvesting**

The onions should be harvested when 65 % to 75 % of the green leaves have turned yellow, the necks have become soft and the leaves are drooping, and the bulbs are covered with well differentiated outer scales signifying that they are in a state of physiological rest.

The onions should be harvested in such a way that they are neither bruised or otherwise damaged. The stem should be cut so that it does not exceed 4 cm after drying (see A.3.4)

**A.3.3 Quality characteristics**

Quantitative inspection of onions for conservation is strongly recommended.

It is necessary to choose onion bulbs of good quality, meeting the following requirements: sound, free from mechanical injuries, well covered by outer scales, well dried, ripe and homogeneous.

The onions should be free from foreign odour.

Bulbs having floral stems, or which are not covered by outer scales, which are double, triple, too large, too small, deformed, or not fully mature, should not be stored.

**A.3.4 Various treatments before storage**

To avoid sprouting, approved phytosanitary inhibitors may be applied if their use is not restricted.

Before storage, the onions should be dried to eliminate excess external moisture and moisture in the outer scales, the rootlets and the neck.

If natural drying is not possible, a suitable method of artificial drying should be used, for example exposure to a current of warm dry air for a period of 4 days up to a maximum of 8 days, depending on the moisture content. The air temperature may be up to a maximum of 30°C and the relative humidity should, if possible, be from 60 % to 70 %. The rate of air flow may be from 2 m<sup>3</sup>/min to 2.5 m<sup>3</sup>/min per cubic metre of bulbs. Ventilation should be effected either with fresh air from outside the store or with a mixture of outside and inside air, with different rates of air change for the two different types of ventilation. Alternatively, the internal air may simply be recirculated in closed circuit, in which case the recommended air circulation ratio is from 40 to 50 per hour.

Drying has been achieved when the moisture content of the outer scales reaches 12 % to 14 %. At this moisture content, bulbs rustle when handled.

To avoid risk of damage to the onions in transport, it is recommended that drying be carried out at the storage site, in a room specially equipped to carry out this treatment.

Artificial drying should be carried out directly after harvesting, while the onions are in a state of physiological rest, because subsequent treatment with warm air (up to 30 °C) promotes sprouting.

### **A.3.5 Putting into store**

Stores for keeping onions should be refrigerated or provided with an air-ventilation system with distribution of air through the floor, and should be perfectly dry, clean and disinfected. Filling of stores should be carried out quickly, without exceeding a period of 7 days to 8 days

It is necessary to avoid storage of onions with other vegetables or fruits to which their particular taste and odour may be transmitted. Storage of onions and garlic in the same store is, however, permissible.

The onions should be put into store as soon as possible after drying, if this has not been carried out in the store. In the case of storage in bulk, if the onions are not completely dry it is necessary to start ventilation immediately, without waiting for the store to be completely filled.

### **A.3.6 Method of storage**

The onions may be stored in bulk, in packages on pallets, in box pallets, in crates, in sacks or in containers. Onions packed in sacks may be stored for only a short period of time.

In the case of storage in bulk, the maximum storage level should be of the order of

- a) 2 m to 2.5 m. for storehouses with natural ventilation, and
- b) 3.5 m to 4.5 m, for storehouses with forced ventilation,

the exact level being dependent on the resistance of the bulbs to crushing.

To avoid damage, packages should be stacked 5 to 7 tiers high, and a gap of 15 cm to 20 cm in the proximity of the side walls and of 5 cm to 8 cm between the stacks of packages should be provided to ensure the free circulation of air.

## **A.4 Optimum storage conditions"**

### **A.4.1 General**

For the conservation of onions, the temperature and humidity conditions are varied according to

- a) the technological phase of conservation:

- b) the specificity of the cultivar:
- c) the storage system:
- d) the storehouse itself, i.e., whether it possesses an ambient-air ventilation system or uses artificial refrigeration.

The temperature and moisture conditions should be maintained constant throughout the storage period. The maximum allowable variations in temperature and relative humidity are +1 °C and +5 % respectively.

Conservation factors should be controlled every day quality control of onions should be carried out every 7 days to 10 days to verify the phytosanitary and behavioural state of the product.

#### **A.4.2 Temperature**

##### **A.4.2.1 Optimum temperature**

Long-term storage of onions may be achieved at various temperatures according to the storage system used and the resistance of the cultivar to low temperatures, as follows'

- a) storage at ambient temperature in stores without artificial refrigeration (with natural or forced ventilation)
- b) storage at a temperature of 0 °C ± 1 °C for cultivars with moderate resistance to cold.
- c) storage at a temperature of 1°C to -2.5°C (i.e., the onions are almost frozen) for cultivars with good resistance to cold

##### **A.4.2.2 Control of temperature conditions**

###### **A.4.2.2.1 Control using cold ambient air**

Air from outside the storehouse may be introduced whenever the temperature outside is less than that inside.

To avoid the risk of frost damage to the onions, air having a temperature of less than -3 °C shall not be introduced into the storehouse. The ventilation and insulation system should be such that the required temperature may be maintained for as long as outside conditions are favourable.

###### **A.4.2.2.2 Control using artificial refrigeration**

In this case, air circulation takes place in a closed circuit. It is recommended that the air be renewed at regular intervals throughout the storage period.

#### **A.4.3 Relative humidity**

To help prevent the development of mould and the appearance of roots, a constant relative humidity of 70% to 75% is recommended.

#### **A.4.4 Air circulation**

To obtain constant temperature and relative humidity, it is necessary to set very strict requirements for the air-circulation system. Two different types of air circulation may be distinguished.

##### **A.4.4.1 Closed-circuit circulation**

The objective of this type of circulation is to promote cooling of the onions to maintain their temperature uniform, and to remove from the packages gases and volatile compounds resulting from

the metabolic processes of the onions.

An air-circulation ratio of 20 to 30 per hour is recommended both for systems using cold ambient air and for systems using artificial refrigeration.

#### A.4.4.2 Air renewal

The high density storage of onions produces an accumulation of carbon dioxide due to the respiration of the onions. It is necessary to eliminate this by introducing fresh air at regular intervals throughout the storage period. The air-circulation system should provide a rate of air change of 20 to 30 per hour.

#### A.4.5 Storage life

When using cooling with ambient air, the storage life may vary from 3 months to 7 months according to the cultivar and the climatic conditions in the country or region in which the onions are stored. When using artificial refrigeration, the expected storage life may be up to 9 months.

#### A.4.6 Operations during and at the end of storage

The onions should not be handled if they exhibit crystals of ice. Precautions should also be taken to avoid any risk of freezing of supercooled onions during handling.

To avoid all traces of moisture on the surface of the bulbs, when the onions are taken out of storage, it is recommended that the onions are kept for approximately 24 h at an intermediate temperature. Then conditioning and packaging of onions for delivery may proceed.

#### A.5 Other conservation processes

Chemical sprouting inhibitors may be used in countries where their use is not restricted. In the case of onions destined for export after storage, account should be taken of the restrictions on the use of chemical inhibitors in force in the importing country.

Interesting results have also been obtained with the use of ionizing radiation of the order of 6 000 rad to 10000 rad. This conservation technique is, however, subject to restrictions in certain countries.

#### A.6 Summary of recommended storage conditions

The technological phases and their duration, and the corresponding conditions that should be effected are indicated in Table A.1.

**Table A.1 — Summary of storage conditions for onions**

Technological phase		Duration days	Temperature °C	Relative humidity, max %	Ventilation rate h/day
<b>Drying</b>		4 to 8	External air or warm air (30 max.)	70	18 to 20
<b>Cooling</b>		10 to 14	+2 to -2	75	16 to 20
<b>Storage</b>	Under ambient conditions	90 to 210	Ambient air (-3 min.)	75	6 to 8
	Under artificial refrigeration	180 to 270	-1 to +1 <sup>1)</sup> -1 to -2.5 <sup>2)</sup>	75	6 to 8
<sup>1)</sup> For the cultivars having a moderate resistance to cold <sup>2)</sup> For cultivars having a good resistance to cold					

## Annex B (informative)

### Commercial production guide



#### B.1 Introduction

Onions are one of the oldest vegetables in continuous cultivation dating back to at least 4,000 BC. The ancient Egyptians are known to have cultivated this crop along the Nile River. There are no known wild ancestors but, the centre of origin is believed to be Afghanistan and the surrounding region. Onions are among the most widely adapted vegetable crops. They can be grown from the tropics to sub arctic regions. This adaptation is primarily due to differing response to day length. Unlike most other species, day length influences bulbing in onions as opposed to flowering. Onion bulbs are placed into three groups based on their response to hours of day length. The short-day bulb varieties with day lengths of 11-12 hours while intermediate bulb varieties with day lengths of 13-14 hours; finally, the long-day varieties bulb with day lengths of 16 hours or greater.

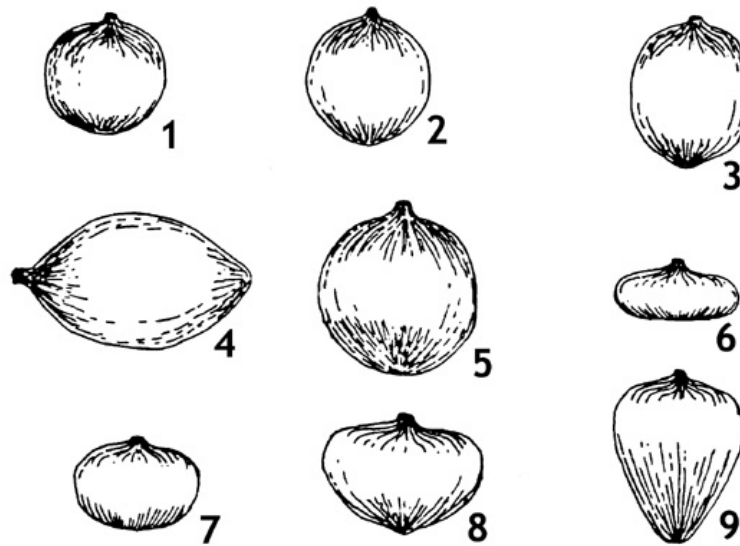
#### Transplant production

Short-day onions can be grown from both seed and transplants, but the majority are grown from transplants. Land for transplant production should not have been in onions or related Alliums for at least 3 years. This is not always possible with fixed centre-pivot systems. Avoid sites with a history of onion diseases and severe weed problems.

Once a site is selected, take a soil test to determine the optimum level of fertility and soil pH. When submitting a soil sample, indicate that they are for transplants or plant-bed onion production. The site should be deep turned to bury any residue from the previous crop.

The plantbed soil should have a pH range of 6.0-6.5 for optimum growth. If the soil pH is low, applications of lime are recommended. Dolomitic lime is preferred over calcitic lime because it supplies calcium and magnesium while adjusting the pH. Changing soil pH is a relatively slow process, so if low pH is suspected early, soil testing and lime application is advantageous to ensure the soil pH is corrected in sufficient time for planting. Soil pH can take several months to change with lime applications.

### Variety selection and characteristics



**Figure 1 — Bulb Shapes**

1 - flattened globe; 2 - globe; 3 - high globe; 4 - spindle; 5 - Spanish; 6 - flat; 7 - thick flat; 8 - Granex; 9 - top

Along with maturity, varieties perform differently on a wide range of quality attributes as well as yield. Varieties can differ for pungency, sugar content, disease resistance, seed stem formation, double centres, bulb shape, and bulb size. Consider all of these characteristics when making decisions on variety selection.

### Soils and fertilizer management

Onions grow best on fertile, well-drained soils. Most sandy loam, loamy sand or sandy soils are also advantageous to sweet onion production. These soils are inherently low in sulfur, which allows greater flexibility in sulfur management to produce sweet onions. Avoid soils with heavy clay content and coarse sandy soils. Clay soils tend to have a higher sulfur content that can lead to pungent onions. Sandy soils are difficult to manage because they require more fertilizer and water.

Always base fertilizer and lime requirements on a recent, properly obtained soil sample. Check with your local county Extension office or crop consultant regarding proper procedures for soil sampling and interpretation of results. Take the soil test a few months prior to crop establishment in order to determine lime requirements and make necessary lime applications in a timely manner. If soil test results show a pH below 6.0, apply and disk in dolomitic lime 2-3 months before land preparation to bring the pH to the optimum range of 6.2-6.5. It is essential to apply sufficient lime to keep the soil pH above 6.0. Low pH can cause nutrient deficiencies during the growing season. Also, high rates of fertilizer used in producing onions cause the pH to drop during the growing season. If the pH is not corrected at the beginning of the onion season, nutrient deficiencies could occur during the year and reduce yields. Calcium and phosphorous deficiencies can often be linked to low pH, even though soil tests indicate adequate levels. Foliar applications of calcium may help overcome calcium deficiencies. But phosphorous deficiencies due to low pH can be difficult to correct during the growing season.

Onions require more fertilizer than most vegetable crops because fertilization of both plant beds and dry bulb onions must be considered. They respond well to additional fertilizer applied 40-60 days after seeding or transplanting. The method of fertilizer application is very important in obtaining maximum yield, with multiple applications ensuring good yields. This increases the amount of fertilizer used by the plant and lessens the amount lost from leaching. More recent research indicates that good results can be obtained with as few as three fertilizer applications. Preplant fertilizer will vary with the natural fertility and cropping history. Proper application methods and function of various nutrients are outlined below.

**Nitrogen (N)** especially in nitrate (NO<sub>3</sub>) form, is extremely leachable. If too little nitrogen is available, onions can be severely stunted. High nitrogen rates are believed to produce succulent plants that are more susceptible to chilling or freezing injury and disease, and to production of flower stalks. Onions, heavily fertilized with nitrogen, are believed to not store well. Finally, excess nitrogen late in the growing season is believed to delay maturity and causes double centers. Make the final nitrogen application at least 4 weeks prior to harvest. Rates of nitrogen vary depending on soil type, rainfall, irrigation, plant populations, and method and timing of applications. Dry bulb production, from transplanting, requires between 125-150 pounds per acre nitrogen. It is usually best to incorporate 25-30 percent of the recommended nitrogen prior to planting; apply the remainder in two to three split applications.

**Phosphorus (P)** is essential for rapid root development. It is found in adequate levels in most soils but is not readily available at low soil temperatures. Because of these factors, under most conditions, apply all of the P preplant and incorporated before transplanting. Count this amount as part of the total seasonal fertilizer application.

**Potassium (K)** is an important factor in plant water relations, cell-wall formation, and energy reactions in the plant. Potassium is subject to leaching from heavy rainfall or irrigation. Therefore, it is best to split K applications by incorporating 30-50 percent of the recommended K before planting and splitting the remainder in 1-2 side dress applications. A low K level makes plants more susceptible to cold injury.

**Sulfur (S)** is an essential element for plant growth. Early applications of sulfur are advisable in direct-seeded and transplanted onions.

**Boron (B)** is required by direct-seeded or transplanted onions in the field. If the soil test shows B levels are low, apply 1 pound of B per acre and incorporate prior to transplanting or seeding. Do not exceed the recommended amount since boron can be toxic to onions.

**Zinc (Zn)** levels determined to be low by soil testing can be corrected by applying 5 pounds of Zn per acre. Excessive amounts of Zn can be toxic, so apply only if needed. Zinc is usually added in the preplant fertilizer.

**Magnesium (Mg)** levels in the soil must be adequate for good onion growth. If dolomitic limestone is used in the liming program, it will usually supply some of the required Mg. However, if soil pH is adequate and the soil-test Mg level is low, apply 25 pounds of Mg per acre in the preplant fertilizer.

A complete fertilizer with minor elements will provide most of the other required nutrients. Micronutrients can become toxic if excessively applied. Apply them only when needed and in precise amounts. Routine visual inspection of onion fields to watch for nutrient deficiencies is always important. However, during periods of high rainfall or frequent irrigation, be particularly aware of the potential for nutrient deficiencies to occur.

Deficiencies of major nutrients cannot be feasibly corrected through foliar nutrient applications. It is important to properly manage soil fertility to maintain optimum growth and development. Some deficiencies of minor elements can be remedially corrected through foliar applications. Thus, it is always best to supply adequate amounts of these nutrients through your basic soil fertility program. Plants use nutrients more efficiently when the nutrients are taken up from the soil. By the time you visually see deficiency symptoms, you have probably already lost some potential yield.

### Plant tissue analysis

Plant tissue analysis is an excellent tool to evaluate crop nutrient status. Use periodic tissue analysis to determine if fertility levels are adequate or if supplemental fertilizer applications are required. Tissue analysis can often be used to detect nutrient deficiencies before they are visible.

Plant tissue analysis is accomplished by sampling the most recently mature leaves of the plant. Take a sample of 20-30 leaves from the field area(s) in question. Check with your local county Extension Office or crop consultant on proper tissue analysis techniques.

## B.2 Cultural practices

Transplants are field set on slightly raised beds approximately 1.2 m wide. Beds are 6 feet centre to centre. These beds or panels, as they are sometimes called, will have four rows of onions spaced 30-35 cm apart and a spacing of 11 cm - 15 cm within the row (Figure 2). The spacing is determined by peg spacing on a pegger used to place holes in the bed surface 2.5 cm – 5 cm deep (Figure 3). Transplants are hand set in each hole.



Figure B.2 — Typical onion field



Figure B.3 — Pegger

Harvest maturity is reached when 20-50 percent of the onion tops are down. In most seasons, onion neck tissue breaks down when the plant is mature. Although this is a good rule-of-thumb for determining when onions mature, the tops may not go down as readily in some years or for some varieties. In addition, early varieties are very day length sensitive and usually go down early and uniformly. Harvest these early varieties when 100 percent of the tops go down. They can be allowed to stay in the field for a week after tops go down and will continue to enlarge. This will increase the yield as the bulbs continue to increase in size. Knowing the variety and carefully inspecting the crop is the best method to determine maturity. Whether the tops go down or not, the neck tissue will become soft, pliable, and weak at maturity. Onions harvested too early may be soft and not dry down sufficiently during curing. In addition, they may begin to grow because they are not completely dormant. If the onions are harvested too late, there may be an increase in post-harvest diseases and sun-scald on the shoulder of the bulb. Although hybrids will have a narrow window of maturity, they will not all mature at once. Generally, a field of onions will be harvested before all the bulbs have their tops down.

Onions are prone to physiological disorders that growers should try to minimize. One such disorder is splits or doubles. This condition is caused by cultural and environmental factors as well as being influenced by genetics. Over-fertilization, uneven watering, and temperature fluctuations (particularly below 20 degrees F) are all believed to influence double formation. Some varieties are more prone to production of doubles than others. Varieties prone to doubling should be seeded a week or so later on the plant beds as well as transplanted a bit later to minimize this disorder.

Onions are biennials, forming bulbs the first year. These act as a food source the following year when the plant flowers. The process of flowering in onions is called bolting. A seed stalk or scape will form very quickly and appear to bolt up. These flower stalks or seed stems can form in the first year if appropriate environmental conditions occur and plant size are favourable. Cool temperatures during the latter part of the growing season, when plants are relatively large, can result in a high percentage of seed stems. There also appears to be a variety component to seed stem formation.

Generally, onions can withstand light to heavy frosts, but hard freezes can result in onion damage. Freeze injury may be readily detectable as trans-lucent or water soaked outer scales of the bulbs. One or two days after the freeze event, onions should be cut transversely to see if translucent scales are present. In some cases, freeze damage may not be readily detectable for several days. In these cases, the growing point may have been affected and subsequent growth will be abnormal, increasing the incidence of doubles. Apparently the growing point is damaged to the extent that two growing

points develop. Under severe freeze conditions the plant may be killed. Control of freeze and frost injury is usually done by cultivating the fields, if such an event is anticipated. Cultivating fields results in a layer of moist soil at the surface that acts as insulation. This holds the day's heat in the soil around the bulb and root. The downside to cultivating is the possible increase of disease caused by throwing up contaminated soil on tender onion tissue.

Onions may develop disorders that are not associated with insect, disease, or nutrient problems. Greening is one such occurrence. This occurs when the bulb is exposed to sunlight for an extended period of time. Early fertilizer application is needed to develop a strong healthy top, which shades the bulb during development.

Sun-scald will occur at the shoulder of all onions that are exposed to sunlight for an extended period of time. Bulb sun-scalding can occur when maturity is reached and harvest is delayed. Harvest should occur as soon as possible after the crop has matured. Scales several layers deep will dry and turn brown. Under severe conditions, the internal tissue may actually cook or become soft and translucent.

Translucent scale is a physiological disorder similar in appearance to freeze injury. The big difference is freeze injury will always affect the outer scales whereas translucent scale may first appear on scales several layers deep in the bulb. Translucent scale is a post-harvest phenomenon caused by high CO<sub>2</sub> in storage facilities. This is most likely to occur in refrigerated storage without adequate ventilation. CO<sub>2</sub> levels above 8 percent will increase the chance of translucent scale. Growers and packers should carefully monitor storage facilities to prevent this.

Physical damage of onions may be confused with Botrytis leaf blight (see disease section). This damage is usually caused by wind blown sand or hail. Strong winds can cause flecking of leaves, particularly in fields with dry sandy soils. Hail damage will usually be more severe, with large (0.32-0.643 cm diameter) white or yellow lesions on the leaves. The shoulders of the exposed bulbs will often have a dimpled feel. In severe cases, the crop can be defoliated and destroyed.

Occasionally plants may exhibit a striped appearance. If this is widespread in a field, S deficiency is the probable cause (see fertility section). If it appears on an isolated plant, it is probably a chimera. Chimeras result when a mutation occurs in the meristematic tissue (growing point) resulting in a striped plant. This should not be a concern.

### **B.3 Diseases of onions**

Onion diseases can cause severe losses by reducing yield and quality of marketable onions. These onion diseases can occur in seedbeds, production fields and storage. Disease management requires a systems approach involving practices such as rotation, sanitation, optimum fertilization, preventive fungicide/bactericide applications, harvest timing and proper handling, harvesting, and storage. If one or more of these practices are omitted, disease management is significantly compromised.

#### **B.3.1 Fungal diseases affecting roots and underground plant parts**

##### **Pink root**

Pink root, caused by the fungus *Phoma terrestris*, is a damaging root disease of onions. This disease is greatly enhanced by stresses imposed on plants such as heat, cold, drought, flooding, and nutrient toxicities/deficiencies. The fungus reproduces and survives indefinitely in soil, so continuous production of onions in the same field results in increased losses to pink root.

**Symptoms:** The name of this disease is its most descriptive symptom. Roots infected by the pink root fungus turn pink or sometimes appear purplish (Figure B.6). Infected roots eventually turn brown and deteriorate. Onions in both seedbeds and production fields can become infected. Early infected plants may die or not produce useable bulbs. Plants infected later are stunted and produce small, unmarketable bulbs.



**Figure B.6 — Pink colored roots of onions infected with pink root (*Phoma terrestris*)**

**Management Options:** Using a long rotation to non-related crops (3-7 years) is the key management strategy for reducing losses to pink root. Correct soil tilth, fertility and water management will reduce stresses that enhance disease development. The optimum temperature for growth and infection by pink root is 79 degrees F, so delaying planting until soil temperatures average 75 degrees F or below will allow onions infected with pink root to grow and develop prior to temperatures that enhance infection. Harvesting onions prior to soil temperatures reaching 79 degrees F allows onions to escape further pink root infection. Fumigation with metam sodium, chloropicrin and 1,3-D dichloropropene (Telone) is shown to increase yields when onions have been planted to fields heavily infested with pink root. Consider onion varieties resistant to pink root and have horticulturally acceptable qualities. Research is continuing to evaluate fumigants on onion performance.

#### **Fusarium basal rot**

Fusarium basal rot is caused by the fungus *Fusarium oxysporum f. sp. cepae*. This disease occurs sporadically in the Vidalia area. Losses to this disease can occur in the field and later when onions are in storage. Like pink root, Fusarium basal rot can build up in soils where onions are grown year after year.

**Symptoms:** Symptoms may be observed in the field as yellowing leaf tips that later become necrotic. This yellowing and/or necrosis may progress towards the base of infected plants. Sometimes leaves of infected plants exhibit curling or curving. Infected bulbs, when cut vertically, will show a brown discoloration in the basal plate (Figure B.7). This discoloration moves up into the bulb from the base. In advanced infections, pitting and decay of the basal plate, rotten sloughed-off roots, and white, fluffy mycelium are all characteristic symptoms and signs of Fusarium basal rot. Sometimes, infected bulbs may not show symptoms in the field but will rot in storage.



**Figure B.7 — Onion basal plate infected with Fusarium basal rot**

**Management options:** Like pink root, using a long rotation (4 or more years) to non-related crops is the key management strategy for reducing losses to Fusarium basal rot. Use of healthy transplants, avoiding fertilizer injury and controlling insects will reduce losses to basal rot. Storing onions at 34

degrees F will help minimize losses. Resistance to Fusarium basal rot has been identified in some commercial onion cultivars (check on current varieties).

### B.3.2 Fungal diseases affecting above ground plant parts

#### Botrytis neck rot

Botrytis neck rot is a most damaging fungal disease affecting onions, with severe losses occurring both in the field and in storage. The fungus causing Botrytis neck rot, *Botrytis allii*, can survive in the soil or on rotting bulbs as sclerotia. Botrytis conidia may arise from these sclerotia and be carried by wind to spread the disease.

**Symptoms:** Although the bulk of losses to Botrytis neck rot are in storage, severe losses can be experienced in field situations. Plants infected in the field exhibit leaf distortion, stunted growth, and splitting of leaves around the neck area. A grayish sporulation of the fungus may be observed between leaf scales near the neck area (Figure B.8). In storage, infection can be internal with no discernable symptoms on the onion. It is not until onions are removed from storage that the infection becomes evident. Apparently, the infection enters the neck and continues to grow undetected in storage until the onions are removed. It has been demonstrated that Botrytis neck rot is not capable of sporulation in controlled atmosphere storage (high CO<sub>2</sub>, low O<sub>2</sub>, refrigerated storage), but continues to grow and destroy infected onion tissue. Infected tissue is sunken, water soaked and spongy with a reddish brown color (Figure B.9). The grayish fungal sporulation can be seen between scales in infected bulbs. The gray mold will later appear on the onion surface and may give rise to hard, black sclerotia.



Figure 8. Gray sporulation of *Botrytis*



Figure 9 — Reddish brown discoloration of neck rot onion scales caused by *Botrytis* neck rot

**Management options:** Harvesting healthy mature onions with a well-dried neck will greatly reduce Botrytis neck rot incidence in storage. Avoid over-fertilization and high plant populations, which lead to delayed maturity and reduced air movement through the canopy, respectively. Curing onions with forced air heated to 98 degrees F will cause the outer scales to dry down and become barriers to Botrytis infection. Storing onions near 34 degrees F at approximately 70 percent relative humidity reduces growth and spread of neck rot. Sanitation through deep soil turning and destroying cull piles helps reduce the amount of *Botrytis allii* inoculum in production fields. A combination of boscolid and pyraclostrobin, as well as these products individually, have been shown to give good control of Botrytis neck rot. Using any fungicide should be integrated into a complete system of disease control. In addition, follow label direction for use.

#### Botrytis leaf blight

Botrytis leaf blight caused by *Botrytis squamosa* is another Botrytis disease. However, this fungus infects onion foliage. This fungus survives in onion debris in the soil or in cull piles as sclerotia. The sclerotia produce conidia that become airborne and spread to foliage in production fields. Infection is greatly increased by long periods of leaf wetness and temperatures around 80 degrees F.

**Symptoms:** Initial symptoms of Botrytis leaf blight are small (less than 0.635 cm in length) whitish, necrotic spots surrounded by pale halos (Figure B.10). Spots often become sunken and elongated. Severely blighted leaves may result in reduced bulb size.





























































