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# International Standard



# 2167

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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

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## Round-headed cabbage — Guide to storage

*Choux pommés — Guide pour l'entreposage*

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2167 was developed by Technical Committee ISO/TC 34, *Agricultural food products*.

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This second edition was submitted directly to the ISO Council, in accordance with clause 5.10.1 of part 1 of the Directives for the technical work of ISO. It cancels and replaces the first edition (i.e. ISO 2167-1974), which had been approved by the member bodies of the following countries :

Australia	Hungary	Romania
Austria	India	South Africa, Rep. of
Belgium	Iran	Sweden
Chile	Israel	Thailand
Czechoslovakia	Netherlands	Turkey
Egypt, Arab Rep. of	New Zealand	United Kingdom
France	Poland	
Germany, F. R.	Portugal	

No member body had expressed disapproval of the document.

# Round-headed cabbage — Guide to storage

## 1 Scope and field of application

This International Standard describes methods for obtaining conditions for the successful conservation, with or without artificial cooling, of round-headed cabbages of varieties derived from *Brassica oleracea* Linnaeus, var. *capitata* Linnaeus<sup>1)</sup>, and from *Brassica oleracea* Linnaeus, var. *sabauda* Linnaeus.

It applies only to varieties which ripen late and which are suitable for prolonged storage.

See also the limits of application given in the annex.

## 2 Reference

ISO 2169, *Fruits and vegetables — Physical conditions in cold stores — Definitions and measurement.*

## 3 Conditions of harvesting and putting into store

### 3.1 Varieties

For storage purposes, only late varieties having firm heads with tightly attached leaves are recommended.

### 3.2 Harvesting

For storage purposes, it is advisable to select cabbages which have been harvested when ripe and in dry weather (firm "head"). Premature harvesting may cause an excessive tendency to withering and, conversely, belated harvesting induces bursting of the cabbages.

The cabbages should be free from disease and physiological defects. Cabbages with damaged or frozen stems should be rejected. The stem of the head should be cut off slightly below the point from which the leaves originate, the latter remaining firmly attached; the cut should be clean in order to prevent the cabbages from being damaged by mechanical action during handling.

If the cabbages are harvested in wet weather, they should be allowed to dry for the necessary period before being stored.

## 3.3 Quality characteristics for storage

Cabbages intended for storage should be fresh in appearance, whole, not run to seed, healthy, clean (in particular free from earth) and free from traces of water.

## 3.4 Putting into store

In order to avoid separation of the leaves from the stem during storage, the cabbages should not be put into storage with other fruits and vegetables which produce ethylene.

## 3.5 Method of storage

Cabbages may be stored loose or in crates.

If the cabbages are stored loose, the system of ventilation shall ensure satisfactory air circulation through the layers of the product.

In order to facilitate air circulation between crates, it is recommended that the latter should not be closely stacked.

The cabbages should be arranged in rows with the stems facing upwards. The height of stacking should not exceed 3 m.

## 4 Optimum storage conditions<sup>2)</sup>

### 4.1 Temperature

A temperature of 0 to + 1 °C is generally recommended as being optimum, but white cabbage will tolerate a temperature of -0,8 °C.

Lowering the temperature below -0,8 °C may cause the tissues of the leaves to decompose.

### 4.2 Relative humidity

The relative humidity should be maintained between 90 and 95 %.

1) The Latin name of this variety is under examination.

2) For definitions and measurement of the physical quantities affecting storage, see ISO 2169.

### 4.3 Air circulation

#### 4.3.1 Mixing

The mixing of air in a closed circuit makes it possible to render the temperature and relative humidity uniform. An air-circulation ratio between 20 and 30 is recommended.

#### 4.3.2 Air change

**4.3.2.1** Changing the atmosphere is desirable in order to remove heat and to prevent an excess of carbon dioxide, due to respiration, building up.

**4.3.2.2** When natural cooling is used, and during periods when it is no longer possible to effect ventilation by the admission of outside air, it is necessary to renew the atmosphere in the store frequently. A mixture of outside air and air from the store can be used if the temperature of this mixture is above 0 °C.

**4.3.2.3** When artificial cooling is used, with mixing in a closed circuit, renewal of the atmosphere should be carried out at regular intervals throughout the period of storage.

**4.3.2.4** In both cases, a flow of 100 m<sup>3</sup> per cubic metre of product per hour is recommended.

### 4.4 Storage life

The expected storage life for late varieties, under the conditions indicated above, is from 3 to 6 months according to the region, variety and conditions in the store.

### 4.5 Operations at the end of storage

The cabbages should be inspected and stripped of the outermost leaves, which may have deteriorated or withered; the stem should also be cut again. They may then be kept for 2 to 3 weeks at temperatures up to + 10 °C.

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## Annex

### Limits of application, horticultural factors and defects arising during storage

#### A.1 Limits of application

This International Standard gives guidance of a very general nature only. Because of the variability of the product according to the time and place of cultivation, local circumstances may make it necessary to specify other conditions of harvesting or other physical conditions in the store.

These recommendations do not apply unreservedly, therefore, to all varieties in all climates, and each specialist will have to judge whether any modifications need to be made.

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

Subject to all possible restrictions arising from the fact that vegetables are living material, the application of the guidance contained in this International Standard and this annex should enable much wastage in storage to be avoided and long-term conservation to be achieved in most cases.

#### A.2 Role of horticultural factors (Influence of the ecology and method of cultivation)

Certain ecological or agrotechnical factors have an adverse effect on the storage life. These concern essentially :

- cabbages harvested too early or too late (for example, cabbages which have burst or run to seed);
- cabbages having leaves which are excessively curled and which do not adhere tightly to the head, spring, summer and autumn varieties;

- cabbages from land which has been over-treated with nitrogenous fertilizer;
- cabbages harvested in rainy weather;
- cabbage heads damaged by lesions caused by frost (see the note), or which have lost most of their leaves or which have had too much of their tops knocked off.

NOTE — In certain cases only, varieties of green cabbage which are resistant to cold can be slightly frosted, but not frozen.

#### A.3 Defects arising during storage

In general, a distinction is made between damage of physiological origin and damage of biological origin.

##### A.3.1 Physiological damage

- Desiccation of the outer leaves if the relative humidity during storage was too low; the leaves may have a glassy appearance if the storage temperature has been too low (freezing); they will then turn brown when warmed up.

- Appearance of small, brown specks, due to lack of oxygen.

- Falling off of the outer leaves, or bursting due to physiological disorders.

##### A.3.2 Biological damage

- Bacterial decomposition, such as blackening of the veins, which is due to *Pseudomonas campestris*, or fungal deterioration.