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Onions — Guide to storage

Oignons — Guide pour l'entreposage

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 1673 was prepared by Technical Committee ISO/TC 34, *Agricultural food products*.

This second edition cancels and replaces the first edition (ISO 1673:1978), of which it constitutes a technical revision.

Annex A of this International Standard is for information only.

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Onions — Guide to storage

1 Scope

This International Standard gives recommendations for the storage, with or without the use of artificial refrigeration, of onions of the species *Allium cepa* Linnaeus, intended for long-term conservation and consumption in the fresh state.

Information on the limits of application of this International Standard are given annex A.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 2169:1981, *Fruits and vegetables — Physical conditions in cold stores — Definitions and measurement*.

3 Conditions of harvesting and putting into store

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.

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 3.4).

3.3 Quality characteristics

Qualitative 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.

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 m³/min to 2,5 m³/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.

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.

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.

4 Optimum storage conditions¹⁾

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.

4.2 Temperature

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 $0\text{ °C} \pm 1\text{ °C}$ for cultivars with moderate resistance to cold;
- c) storage at a temperature of -1 °C to $-2,5\text{ °C}$ (i.e. the onions are almost frozen) for cultivars with good resistance to cold.

4.2.2 Control of temperature conditions

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.

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

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.

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.

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.

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.

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.

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.

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.

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.

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 10 000 rad. This conservation technique is, however, subject to restrictions in certain countries.

6 Summary of recommended storage conditions

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

Table 1 — Summary of storage conditions for onions

Technological phase		Duration	Temperature	Relative humidity	Ventilation rate
		days	°C	max. %	h/day
Drying		4 to 8	External air or warm air (30 max.)	70	18 to 20
Cooling		10 to 14	+ 2 to – 2	75	16 to 20
Storage	under ambient conditions	90 to 210	Ambient air (– 3 min.)	75	6 to 8
	under artificial refrigeration	180 to 270	– 1 to + 1 ¹⁾ – 1 to – 2,5 ²⁾		
1) For cultivars having a moderate resistance to cold.					
2) For cultivars having a good resistance to cold.					

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Annex A

(informative)

Limits of application

This International Standard 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 International Standard 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 International Standard 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 International Standard should enable much wastage in storage to be avoided and thus should enable long-term storage to be achieved in most cases.

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