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Fresh pineapples — Storage and transport

Ananas frais — Entreposage et transport

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Foreword

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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 1838 was prepared by Technical Committee ISO/TC 34, *Agricultural food products*, Sub-Committee SC 14, *Fresh fruits and vegetables*.

This second edition cancels and replaces the first edition (ISO 1838:1975), which has been technically revised.

Annex A of this International Standard is for information only.

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Introduction

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

The degree of maturity at harvest time, which determines the duration of storage, should be chosen according to the duration of transport and marketing operations. This duration varies considerably, hence the clause dealing with the ripeness of the pineapples cannot have a general application.

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

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

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Fresh pineapples — Storage and transport

1 Scope

This International Standard gives guidance on conditions for the successful keeping, with or without the aid of artificial cooling, of fresh pineapples, *Ananas comosus* (L.) Merrill, during storage between the place of production and the place of consumption and during maritime transport.

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 Definitions

For the purposes of this International Standard, the definitions given in ISO 2169 apply.

4 Conditions for harvesting and storage

4.1 Varieties

The products covered by this International Standard are fresh fruits, intended for storage and belonging to the following cultivars:

— Cayenne lisse (type and Hilo)

— Baronne de Rothschild

— Queen (Natal Queen, Ripley Queen, MacGregor, Comte de Paris, Alexandra)

— Abacaxi (Sugarloaf, Eleuthera, Pernambuco)

— Red Spanish (Singapore, Spanish, Cabezona)

This list is not restrictive.

4.2 Harvesting

The degree of maturity of fresh pineapples should be determined in terms of their physiological condition¹⁾ and the number of days which will elapse between harvesting and sale to the retailer.

Harvest time is determined when the base of the fruit has changed in colour from green to yellow or light brown. Fruits may be harvested to be sold fresh before striking colour changes have occurred.

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

degree of maturity 1: green;

degree of maturity 2: ripe.

4.3 Characteristics for storage

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

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

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

1) The physiological condition of the fruit is defined by its suitability at the time of harvest for reaching the required state of ripeness for consumption, at the point of retail sale, after normal storage or transport.

crops from temperate countries are tolerated in small numbers.

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

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

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

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

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

4.4 Putting into storage

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

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

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

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

4.5 Method of storage

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

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

As far as possible, pineapples of the Cayenne lisse variety, which are particularly susceptible to bruising,

should not come into contact with the vertical walls of the packages.

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

For measurement of the physical quantities affecting storage, see ISO 2169.

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

5.1 Cooling

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

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

5.2 Temperature

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

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

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

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

5.3 Relative humidity

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

5.4 Air circulation

5.4.1 Air-circulation ratio

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

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

5.4.2 Rate of air change

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

6 Storage life

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

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Annex A (informative)

Wastage during storage

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

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

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