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Fresh pineapples — Guide to storage and transport

Ananas frais — Guide pour l'entreposage et le transport

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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.

Prior to 1972, the results of the work of the Technical Committees were published as ISO Recommendations; these documents are now in the process of being transformed into International Standards. As part of this process, Technical Committee ISO/TC 34 has reviewed ISO Recommendation R 1838 and found it technically suitable for transformation. International Standard ISO 1838 therefore replaces ISO Recommendation R 1838-1970 to which it is technically identical.

ISO Recommendation R 1838 was approved by the Member Bodies of the following countries :

Australia	Hungary	Poland
Brazil	India	Portugal
Chile	Iran	Romania
Czechoslovakia	Israel	South Africa, Rep. of
Egypt, Arab Rep. of	Netherlands	Turkey
France	New Zealand	United Kingdom
Greece	Peru	U.S.S.R.

No Member Body expressed disapproval of the Recommendation.

The Member Body of the following country disapproved the transformation of ISO/R 1838 into an International Standard.

Poland

Fresh pineapples — Guide to storage and transport

0 INTRODUCTION

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

The degree of ripeness 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 ripeness 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.

1 SCOPE AND FIELD OF APPLICATION

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

2 REFERENCE

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

3 CONDITIONS FOR HARVESTING AND PUTTING INTO STORE

3.1 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.

3.2 Harvesting

The degree of ripeness 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.

Three degrees of *apparent* ripeness can be distinguished, according to the outside coloration of the fruit, namely :

- degree of ripeness 1 : with the beginning of the orange-yellow coloration at the base of the fruit, which is called *fruit on the turn*;
- degree of ripeness 2 : the orange-yellow coloration having developed from the lower quarter to halfway up the fruit, which is called *half-ripe fruit*;
- degree of ripeness 3 : the orange-yellow coloration having extended from halfway to the whole of the fruit, which is called *ripe fruit*.

The coloration is not a safe criterion for the actual ripeness of pineapples.

The actual ripeness of pineapples is determined by examining the state of the flesh in a cross-section of the fruit at its largest diameter perpendicular to the vertical axis.

The earliest stage for storage corresponds to the degree of apparent ripeness 1.

Fruit of the Cayenne lisse variety which has gone beyond the optimum stage of ripeness has a cross-section with translucent areas covering more than half the surface of the section (excluding the surface of the core). The optimum stage for storage is defined by the degree of apparent ripeness 2 or 3 according to the keeping time, the colour of the flesh and the extent of the translucent zone in the cross-section of the fruit.

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.

3.3 Qualitative 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 crops from temperate countries are tolerated in small numbers.

They should not have unhealed injuries or recent bruises, as pineapples 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 and 30 mm and its cross-section should show a clean cut which should be disinfected by an agreed fungicide (for example 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.

3.4 Putting into store

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

The interval between cutting 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, the vehicles standing in the shade.

3.5 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.

4 OPTIMUM STORAGE AND TRANSPORT CONDITIONS¹⁾

(in the case of artificial cooling)

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

4.1 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 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 of 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).

4.2 Keeping at storage temperature

4.2.1 Temperature

After cooling, the storage temperature of pineapples should be +7,5 to +8 °C. 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.

4.2.2 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 % is maintained at the coldest point of the refrigerated enclosure.

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

4.3 Air circulation

4.3.1 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.

4.3.2 Rate of air change

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

4.4 Storage life

The storage life of the pineapples depends on the degree of ripeness; it is between 10 days and 1 month from the time of harvesting.

ANNEX

WASTAGE IN STORAGE

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

- too low a storage temperature : temperature below $+7^{\circ}\text{C}$, with darkening of the centre of the pineapple and breakdown of the tissues;
- 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*, *Penicillium*). 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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