INTERNATIONAL STANDARD

ISO 6660

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Mangoes — Cold storage

Mangues — Entreposage réfrigéré

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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 6660 was prepared by Technical Committee ISO/TC 34, *Agricultural food products*, Subcommittee SC 14, *Fresh fruits and vegetables*.

This second edition cancels and replaces the first edition (ISO 6660:1980), which has been technically revised.

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Introduction

The mango is indigenous to the Assam/Burma region and innumerable varieties are cultivated. It is a seasonal crop and highly perishable. Fruits picked at the proper stage of maturity can be kept in the fresh state for hardly a week under normal conditions. It is therefore necessary that fruits be kept under proper conditions to prolong their life for fresh consumption or processing.

Some guidelines for storage of the more usual varieties of mangoes are given in this International Standard. It is hoped that these guidelines will prove helpful in increasing shelf-life and in preventing wastage.

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Mangoes — Cold storage

1 Scope

This International Standard gives guidance on conditions for the successful storage of the more usual varieties of mangoes (*Mangifera indica* Linnaeus), for fresh consumption and for processing into various products.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were 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 editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 750:1981, *Fruit and vegetable products — Determination of titratable acidity.*

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

ISO 2173:1978, *Fruit and vegetable products — Determination of soluble solids content — Refractometric method.*

3 Conditions of harvesting and putting into store

3.1 Harvesting

Mangoes should be picked at the stage of full maturity. In the case of mangoes to be stored for later consumption or processing, harvesting should be carried out just prior to maturity. The principal criteria which may be used to determine the optimum stage of harvest maturity are as follows.

a) Firmness of the flesh: judged by a fruit pressure tester.

b) Skin colour: fruits are harvested when the deep green colour of the skin is just beginning to become lighter. For pickles, green fruits are preferable to maintain acidity.

c) Age: expressed as the number of days elapsed since full flowering.

d) Total soluble solids content: measured by a refractometer at 20 °C (see ISO 2173), or at room temperature with application of the corresponding temperature correction.

e) Acidity: measured by titrating the mango juice with an alkaline solution (see ISO 750).

f) Flesh colour.

g) Relative density.

h) Shape: mangoes with full cheeks are harvested.

The values obtained from these criteria are not universally valid; for a given variety they vary from one region to another and it is for the grower to decide on his own criteria for picking, on the basis of experience.

3.2 Quality characteristics for storage

Fruit to be put into storage should be sound, free from blemishes, bruises or obvious physiological disorders, and free from any visible sign of fungal or bacterial attack. It should be clean, and free from traces of water and dirt.

3.3 Various treatments before storage

Fumigation is necessary if the fruit has been produced in areas of infestation by fruit flies.

The practice of pre-ripening should be forbidden.

Fruit should be dipped in a wax emulsion containing fungicide in a suitable concentration and dried in a current of hot air, in order to delay ripening.

3.4 Putting into store

After harvesting, the fruit should be put into the store as soon as possible since harvested fruits ripen quickly.

The fruit should be packed in cartons, wooden crates or wood and cardboard boxes. The number of fruits packed in each container depends on the dimensions of the fruit and on the capacity of the containers. Cartons should be provided with round holes for adequate ventilation. Boxes may have six holes in both top and bottom, three holes in each shorter side, and six holes in each longer side. The size of holes may be about 30 mm. Boxes should be stored in the shade, in a rat-proof room.

3.5 Method of storage

The container should be of such a nature and so arranged in the store as to permit free circulation of air and to protect the fruit from crushing and damage. As an indication, storage densities of 250 kg to 300 kg per cubic metre of usable space are considered suitable. The use of box pallets may, however, increase the storage density by approximately 10 %.

4 Optimum conditions of storage

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

4.1 Without refrigeration

4.1.1 Temperature and relative humidity

Mangoes may be stored in well-ventilated premises at a temperature of 30 °C ± 2 °C. The relative humidity should be between 60 % and 85 %.

4.1.2 Storage life

Recommendations are given in table 1.

Table 1

Variety	Storage life days	Remarks
Badami	12 to 16	Until ripened to an edible state
Neelum	8 to 12	
Peter (Raspuri)	8 to 12	
Malgoa	8 to 12	
Totapuri	16 to 20	

4.2 Refrigerated storage

4.2.1 Pre-cooling

Pre-cooling is recommended when the fruit is to be kept for long periods, and the final temperature should be reached within a maximum of 3 days to 4 days.

The following conditions should be applied:

a) pre-cooling temperature: 13 °C ± 2 °C;

b) air-circulation ratio: 100 to 200;

c) relative humidity: 90 %.

4.2.2 Storage

4.2.2.1 Temperature

The recommended temperature for the storage of some varieties is given in table 2.

4.2.2.2 Relative humidity

The optimum relative humidity for storage is between 85 % and 90 %.

4.2.2.3 Air circulation

There should be a uniform distribution of air within the cold store, the rate of mixing being sufficient to maintain the spatial difference in temperature and humidity to within reasonable limits. An air-circulation ratio between 20 and 30 is recommended.