International Standard 6660

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Mangoes — Guide to storage

Mangues — Guide pour l'entreposage

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Foreword

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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.

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It has been approved by the member bodies of the following countries :

Austria	Hungary	South Africa, Rep. of
Chile	India	Spain
Czechoslovakia	Israel	Thailand
Egypt, Arab Rep. of	Kenya	Turkey
Ethiopia	Mexico	Yugoslavia
France	Romania	

No member body expressed disapproval of the document.

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Mangoes — Guide to storage

0 Introduction

The mango (*Mangifera indica* L.) 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 human consumption or processing.

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

1 Scope and field of application

This International Standard describes methods for obtaining conditions for the successful storage of the more usual varieties of mangoes, for table purposes and for processing into various products.

2 References

ISO 750, *Fruit and vegetable products — Determination of titratable acidity*[1].

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

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

3 Conditions of harvesting and putting into store

3.1 Harvesting

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

a) Firmness, judged by a fruit pressure tester; the fruit should be firm.

b) Skin colour, the stage 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 and applying 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.

3.1.2 These criteria may vary from variety to variety and, for a given variety, from region to region. Some of the physical, chemical, and organoleptic characteristics of the varieties are given below.

3.1.2.1 Variety Alphonso, Badami (India)

a) Physical characteristics

Skin colour : Olive green, with prominent white specks, white waxy bloom.

Development stages of shoulders at stem end :

1) Not developed

2) Partly developed

3) Well developed

NOTE — Stages 2) and 3) are preferred for harvesting.

Mass of individual fruit : Over 200 g

Texture : Firm

Flesh colour : Cream

1) At present at the stage of draft. (Revision of ISO/R 750-1968.)

b) Chemical characteristics

Total soluble solids content : 8 ± 1 % (*m/m*)

Acidity (expressed as malic acid) : 3,5 ± 0,2 % (*m/m*)

The above characteristics are also applicable to the Peter variety.

3.1.2.2 Variety Carabao (Philippines)

a) Physical and organoleptic characteristics

Fruit size : Medium to large, mass about 240 g.

Shape : Oblong with blunt apex and rounded base, slightly flattened but with full cheeks, beak rather indistinct and variable, sometimes coinciding with the apex.

Skin : Smooth, yellow and thin.

Flesh : Yellow, very tender and melting.

Flavour : Very delicate, aromatic and spicy.

Fibre : Medium coarse, but short and confined almost entirely to the edge of the seed.

b) Chemical characteristics (stage of optimum eating quality)

Total soluble solids content : 6,5 % (*m/m*)

Titratable acidity : 2,5 % (*m/m*)

3.1.2.3 Commercial mango varieties cultivated in Egypt

See table below.

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

3.3.1 The practice of pre-ripening should be forbidden.

3.3.2 Fruits 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

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

3.4.2 The fruits 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. Store the boxes 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. It should be such as to avoid crushing and damaging of fruits at the bottom by the weight of the fruits on top. As an indication, storage densities of 250 to 300 kg per cubic meter 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[1)]

4.1 Without refrigeration

4.1.1 Temperature and relative humidity

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

Table

Characteristic \ Variety	Himdi	Pairi	Tymour	Company	Zebba
Fruit size	Medium	Medium	Medium-large	Medium-large	Large
Shoulders	Not developed	Not developed	Partly developed	Not developed	Not developed
Skin colour	Light green	Green, with reddish cheek	Olive green, with white waxy bloom	Light green	Olive green, with white waxy bloom
Texture	Firm	Firm, little juice	Firm	Firm	Firm with few fibres

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

4.1.2 Storage life

Variety	Storage life days	
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 to 4 days.

The following conditions shall be applied :

a) pre-cooling temperature : 30 ± 2 °C;

b) air-circulation ratio : 100 to 200;

c) relative humidity : 90 %.

4.2.2 Storage

4.2.2.1 Temperature

The annex gives the recommended temperature for some varieties.

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 keep the spatial difference in temperature and humidity within reasonable limits. An air-circulation ratio between 20 and 30 is recommended.

4.2.2.4 Air change

Mangoes stored in densely packed form have the effect of producing an accumulation of carbon dioxide and heat due to respiration; if the cold store is sufficiently gas-tight, some means of ventilation for changing the atmosphere should therefore be provided.

4.2.3 Storage life

The annex gives the expected storage life for different varieties under the storage conditions mentioned above.

4.2.3.1 It is necessary in every case that the storage is not prolonged beyond limits compatible with the maintainance of good quality.

4.2.3.2 It is essential to draw samples of the fruits periodically so as to allow detection of any deterioration which may be taking place during storage.

Annex

Recommended optimum conditions for cold storage of mangoes (relative humidity 85 to 90 %)

Variety	Recommended temperature °C	Expected storage life weeks
Carabao (Philippines)	9 to 10	4 to 5
Alphonse & Totapuri (of Sudan)	> 13	—
All Egyptian varieties except Company	10	2 to 3
Company (Egypt)	10	4 to 5