IS 9303 (1979): Guide for Cold Storage of Table Grapes [FAD 10: Processed Fruits and Vegetable Products]

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IS : 9303 - 1979
(Reaffirmed 2001)

Indian Standard

GUIDE FOR COLD STORAGE OF TABLE GRAPES

UDC 664·853·037·1 (026) : 634·836·14

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Price Rs 6·00

September 1980

Indian Standard

GUIDE FOR COLD STORAGE OF TABLE GRAPES

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GUIDE FOR COLD STORAGE OF TABLE GRAPES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 28 October 1979, after the draft finalized by the Fruits and Vegetables Sectional Committee had been approved by the Agricultural and Food Products Division Council.

0.2 To ensure fuller utilization of perishable foodstuffs, such as fruits and vegetables, it is necessary that they should be preserved under conditions so as to maintain their fitness for human consumption over a period of time. For storage of various fruits and vegetables on scientific lines a series of Indian Standard guides are being issued.

0.3 In the preparation of this standard, considerable assistance has been drawn from ISO/R 2168 'Table grapes — Guide to cold storage' issued by International Organization for Standardization. Work carried out at the Central Food Technological Research Institute, Mysore has also been duly incorporated.

0.4 The Institution had earlier issued IS : 7252-1974* which prescribes definitions and information concerning measurement of physical factors in cold stores.

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1. SCOPE

1.1 This guide gives conditions for obtaining prolonged storage by cold storage, of certain varieties of table grapes (*Vitis vinifera* and *Vitis labrusca*.)

1.2 The limits of application of this guide are given in Appendix A.

2. CONDITIONS OF HARVESTING AND COLD STORAGE

2.1 Varieties — A list containing some examples of varieties suitable for long-term storage is given in Appendix B.

*Guide for testing of physical conditions for cold storages.

2.2 Harvesting — The grapes should be harvested ripe, since they do not develop during the storage period. When the grapes are harvested late, their storage life is short, with the exception of grapes cultivated under glass and harvested in dry weather. Nevertheless, if the harvesting has taken place at the end of a period of rain or irrigation, a shorter storage life is to be expected. Application of a growth regulator like gibberellic acid in the field before harvesting would also reduce the storage life.

2.2.1 The means most frequently used for checking the state of ripeness are as follows:

a) Organoleptic criteria characteristic to the variety;

b) Refractive index of the pressed juice — about 13 to 20 depending on to the variety and region of cultivation;

c) Ratio $\frac{\text{total sugars, expressed in grams of glucose per litre of juice}}{\text{acidity, expressed in grams of anhydrous tartaric acid per litre of juice}}$

(This ratio should be about 18).

2.2.2 The bunches should be picked with care, and should preferably be packed direct in their storage packaging.

2.3 Quality Characteristics for Storage — The bunches should be sound, free from any visible signs of fungal attack, clean and free from traces of water in the liquid state.

2.3.1 The grapes should be spaced as uniformly as possible on the stalk and practically covered with bloom. The stalk should be green and turgid.

2.3.2 It is not advisable to store bunches with damaged fruit, or bunches having grapes which are too close together or abnormally arranged on the stalk (clear stalk). Diseased and immature fruits should be pruned. Pruning may be carried out, provided that it does not produce too great a cleared area.

2.4 Disinfection — The cold store and, where applicable, the packages should be disinfected beforehand by a suitable method.

2.4.1 It is recommended that the grapes be given a treatment of permitted antifungal agents before or after harvesting, as necessary (*see* **4**).

2.5 Cold Storage — The bunches shall be put into cold storage as early as possible after harvesting. Delay may result in stem drying, berry shrivel, shatter and infection by decay organism.

2.5.1 If the location of the cold store makes immediate storage impossible, the grapes shall be stored in a cool place protected from sunlight for a maximum of 24 hours.

2.6 Method of Storage

2.6.1 *Package* — Any of the following may be used.

2.6.1.1 *Wooden package*

a) *Capacity* — about 5 kg of fresh grapes;

b) *Internal dimensions* — 390 × 260 × 145 mm;

c) *End members* — each consists of single plank of dimensions 260 × 145 × 15 mm;

d) *Side members* — each consists of single plank of dimensions 410 × 135 × 10 mm;

e) *Bottom members* — 3 pieces, each piece 410 × 75 × 10 mm fixed to end members;

f) *Bottom* — in addition to (e), shall be provided with two cleats of 150 × 35 × 15 mm each fixed at a distance of 75 mm from each member;

g) *Top members* — three pieces of same dimension as bottom member. These shall form two longitudinal aeration gaps and shall not have cleats. Top members are fixed after the box shall be packed with grapes.

2.6.1.2 *Plywood panel package (with 6,3 ply plywood panels)*

a) *Capacity* — about 5 kg of fresh grapes;

b) *Internal dimension* — 380 × 260 × 150 mm;

c) *End panel* — 260 × 150 mm sheet fixed with two vertical; cleats of 190 × 35 × 10 mm and two horizontal cleats of 190 × 35 × 10 mm;

d) *Side panels* — each consists of 420 × 35 × 10 mm sheet fixed at lengthwise edge. Each panel should have 11 circular holes of 1·5 cm diameter spread in two rows for aeration;

e) *Bottom panel* — after assembling four panels (two end and two sides) a sheet of plywood of 420 × 190 mm be fixed;

f) *Top panels* — one plywood panel of 420 × 150 mm with bottom size 35 × 10 mm fixed at two sides. Panel should be provided with 10 holes of 1·5 cm diameter.

2.6.2 It is recommended that the bunches be packed in a single layer. The contents of each package should be uniform, in order to facilitate checking during storage. The bunches should not be packed together too tightly in the packages. Paper shavings may be used as cushioning material.

2.6.3 In a sealed package, the grapes rapidly acquire an unpleasant flavour characteristic of fermented products.

3. OPTIMUM STORAGE CONDITIONS

3.1 Temperature — The optimum temperature limits for keeping are from —1·5° to 0°C. (For grapes cultivated under glass: from 0° to +1°C.) The air temperature should be kept constant throughout the entire storage period.

3.2 Relative Humidity — The relative humidity should be kept at 85 to 90 percent.

3.2.1 After a more or less prolonged period of time, relative humidities lower than 85 percent may give rise to desiccation of the stalks and pedicels.

3.3 Storage Life — The storage life varies with the variety and the conditions of harvesting, storage and also the time lag between the harvesting and putting into cold storage. A period of 8 weeks is biologically possible, but when it is desired to keep the stalks green and turgid it is difficult to exceed a storage life of 6 weeks.

3.4 Air Circulation — Efforts should be made to obtain suitable mixing of the air (an air circulation ratio of between 30 and 40 for example), in order to render the temperature and relative humidity as uniform as possible.

3.5 Operations at the End of Cold Storage — Care should be taken to avoid condensation of water on the surface of the grapes on leaving the cold store. Under no circumstances should the grapes be handled while wet. They should be subjected to preliminary drying in shade, with the help of fans.

3.5.1 In many cases it will be necessary to carry out a pruning operation intended to remove grapes which have rotted, burst, dried out, etc.

4. ADJUNCTS TO STORAGE

4.1 To inhibit the development of fungal growths, particularly Botrytis, it is necessary to use permitted antifungal agents. Sulphur dioxide should be generally used for pre-treatment (*see* **2.4**) except for coloured berries. Recommended methods for giving the treatment are given in Appendix C.

APPENDIX A

(*Clause* 1·2)

FIELD OF APPLICATION

A-1. LIMITS OF APPLICATION

A-1.1 This standard provides guidance of a very general nature only. Because of the variability of the fruit according to the time and place of cultivation, local circumstances may make it necessary to specify other conditions of harvesting or other physical conditions in the store.

A-1.2 This standard does not apply to all varieties in all climates, and it will remain for each specialist to be the judge of any modifications to be made.

A-1.3 Moreover, this standard does not take into account the role played by horticultural factors, and wastage during storage is not dealt with. The importance of these two subjects has not been forgotton, but the influential factors, that is ecological or agrotechnical factors, are not very well known. Moreover, the origin of several of the most common physiological disorders is still uncertain, as are often the appropriate means of combating them. It has therefore, seemed difficult to attempt to prepare standards on those two points.

A-1.4 Subject to all possible restrictions arising from the fact that fruits are living material and may vary considerably, application of the recommendations contained in this standard should enable much wastage in storage to be avoided and long-term storage to be achieved in most cases.

APPENDIX B

(*Clause* 2·1)

LIST OF VARIETIES

B-1. Following list gives some examples of varieties of grapes for which storage is recommended according to the conditions of this guide.

Sl No.	*Name of the Variety*	*Temperature*	*Humidity*	*Period*
i)	Anab-e-sbahi	0°C	85 to 90 percent	6-8 weeks
ii)	Bangalore Blue (coloured)			
iii)	Pacha Draksha			
iv)	Thomson Seedless			
v)	Cheema Sahibi			
vi)	KaliSahibi (coloured)			

APPENDIX C

(*Clause* 4·1)

RECOMMENDED METHOD FOR TREATMENT

C-1. TREATMENT BY FUMIGATION PROCESSES OF SHORT DURATION

C-1.1 On the introduction of the grapes into the cold store the first sulphur dioxide treatment is given, either at a concentration of 1 percent of the volume of the empty store, with the gas mixture maintaining contact with the grapes for 20 minutes.

C-1.1.1 The sulphur dioxide is then removed by the introduction of fresh air.

C-1.2 In the course of storage, a sulphur dioxide treatment is applied every 10 or 15 days for a period of 20 min at a concentration of 0·25 percent after which the gas is removed by ventilation or by passing the air of the room over water atomizers.

NOTE — Fumigation presents a number of disadvantages; it is very difficult to mix uniformly the atmosphere of the store in a suitable manner, and the use of this technique often gives rise to discoloration of the grapes or to a foreign taste.

C-1.2.1 The renewal of the atmosphere necessary to remove the sulphur

dioxide after each treatment often has the effect of disturbing the temperature and relative humidity conditions in the cold store.

C-2. TREATMENT BY THE EMISSION OF SULPHUR DIOXIDE ORIGINATING FROM CHEMICAL COMPOUNDS PLACED IN THE PACKAGE CONTAINING THE GRAPES

C-2.1 In order to avoid all the disadvantages of fumigation, it is possible to introduce into the packages containing the grapes sulphur dioxide-generating compounds, the best known of which is potassium metabishulphite.

C-2.1.1 Under continuous conditions the concentration of sulphur dioxide in the atmosphere should be between 80 and 300 ppm.

C-2.1.2 For the proper distribution of the generating agent within the packages, different techniques are possible.

C-2.2 The spraying, onto wood fibre placed in the package, of a solution of potassium metabisulphite (for example, the spraying of 20 ml of a 40 percent potassium metabisulphite solution per case containing about 5 kg of grapes) is found suitable.

C-3. DISTRIBUTION OF POTASSIUM METABISULPHITE IN GRANULATED CORK OR SAWDUST IN CONTACT WITH THE GRAPES IN THE PACKING (FOR EXAMPLE, 1·4 g per kg OF GRAPES)

C-3.1 The operations described in **C-2** are suitable only for short and medium keeping periods, as metabisulphite is used up very quickly, at first producing quantities of sulphur dioxide which often prove toxic to the grapes, and cease to give off anything at all after a few weeks.

C-3.2 In order to regularize and slow down the emission of sulpur dioxide from the metabisulphite, it is possible, for example, to wrap the metabisulphite in porous paper, or doses of metabisulphite in packages of plastics material; however, conditions only permit a limited retardation of the emission of sulphur dioxide.

C-3.3 There is also a different method which makes it possible to produce, and maintain at a constant rate, a given quantity of sulphur dioxide within the atmosphere of a plastics package. In this method, the metabisulphite in aqueous solution is sealed in a polyethylene sachet; the whole arrangement is called a generator sachet. The particular permeability characteristics of the polyethylene film to sulphur dioxide ensures the regular release of the gas.

C-3.3.1 It is possible to adjust at will, to a given level, the rate of sulphur dioxide released, by varying the thickness of the film, the surface area of the sachet and the quantity of metabisulphite. The generator sachets are placed in contact with the bunches, between these and the upper face of the packaging (a polyethylene wrapping with small perforations).

C-3.3.2 A relationship is established between the quantities of sulphur dioxide released continuously by the generator sachet and those which diffuse towards the outside through the walls and perforations of the package, as a result of which it is possible to maintain, throughout the preservation period, a sulphur dioxide content inside the package ranging between the limits of 80 and 300 mg per kg.

C-3.4 Following new device, which is very similar to the previous one, is also recommended.

C-3.4.1 A sheet of kraft paper impregnated with metabisulphite is kept in contact with the humidity of the atmosphere in the package, the metabisulphite will immediately start emitting sulphur dioxide for a very short time. A second sheet of kraft paper having pores which contain metabisulphite is kept, the sulphur dioxide will diffuse through the kraft paper giving rise to a second sulphur dioxide emission for a longer period.

C-3.4.2 This procedure does not always make it possible to avoid a higher sulphur dioxide content, and thereby a foreign flavour.

(*Continued from page* 2)

Storage Conditions for Fresh Fruits and Vegetables Subcommittee, AFDC 23 : 8

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INDIAN STANDARDS

ON

STORAGE CONDITIONS FOR FRUITS & VEGETABLES

IS:

6669-1972 Guide for storage of apples
6670-1972 Guide for storage of potatoes
7191-1974 Guide for storage of tomatoes
7192-1974 Guide for storage of citrus fruits
7252-1974 Guide for testing of physical conditions in cold stores
7730-1975 Guide for storage of pears
7731-1975 Guide for storage of peaches
9303-1979 Guide for cold storage of table grapes
9304-1979 Guide for storage of mangoes