

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION R 1212

APPLES

GUIDE TO COLD STORAGE

1st EDITION

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BRIEF HISTORY

The ISO Recommendation R 1212, *Apples – Guide to cold storage*, was drawn up by Technical Committee ISO/TC 34, *Agricultural food products*, the Secretariat of which is held by the Magyar Szabványügyi Hivatal (MSZH).

Work on this question led to the adoption of Draft ISO Recommendation No. 1031 which was circulated to all the ISO Member Bodies for enquiry in October 1966. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Australia	Greece	Paraguay
Brazil	Hungary	Poland
Bulgaria	India	Portugal
Chile	Iran	Romania
Colombia	Italy	South Africa, Rep. of
Czechoslovakia	Korea, Rep. of	United Kingdom
France	Netherlands	Turkey
Germany	New Zealand	U.S.S.R.

No Member Body opposed the approval of the Draft.

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in April 1970, to accept it as an ISO RECOMMENDATION.

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INTRODUCTION

This ISO Recommendation 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.

This ISO Recommendation does not apply unreservedly, therefore, to all varieties in all climates, and each specialist will himself decide on any modifications to be made.

Moreover, this ISO Recommendation does not take into account the role played by horticultural factors, and wastage in storage is not dealt with. The importance of these two subjects has not been forgotten, but the influential factors (i.e. ecological or agrotechnical factors) are not very well known; moreover, the origin of many of the most frequent physiological disorders of apples is still uncertain, as are often the appropriate means of combating them. It has therefore seemed difficult to prepare international recommendations on these two points.

Nevertheless it has seemed useful to give, in an appendix and for purposes of record, a few recommendations which appear sufficiently well founded in the present state of knowledge.

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

1, SCOPE

This ISO Recommendation describes methods for obtaining conditions for the successful cold storage of apples.

2. CONDITIONS OF HARVESTING AND PUTTING INTO STORAGE

2.1 Harvesting

The principal criteria used to determine the optimal state of ripeness for harvesting are as follows* :

- the ease of picking (the fruit is picked when it is easily separated from its spur; this is not however an objective criterion);
- the colour (period of change from green to yellow), which is judged with the aid of standard tables;
- the age of the fruit, expressed as the number of days that have elapsed since full flowering.

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.

2.2 Quality characteristics for storage

Fruit put into cold storage should be sound, free from 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 in the liquid state.

2.3 Various treatments

The practice of pre-ripening should be forbidden, as it is the source of much wastage in storage.

2.4 Putting into storage

The fruit should be put into the cold immediately after harvesting.

2.5 Method of storage

The packages should be of such a kind, and so arranged in the cold store, as to permit free circulation of air. As an indication, storage densities of 200 to 250 kg per cubic metre of usable space, for apples in cases, are considered as maxima that should not be exceeded.

The use of box pallets makes possible an increase of 10 to 20 % in storage density.

3. OPTIMAL CONDITIONS OF STORAGE

3.1 Temperature

Most varieties of European origin keep in the neighbourhood of + 4 °C; a lower temperature is harmful. Apples of American origin, on the other hand, keep well at 0 °C. There are exceptions : for example the Jonathan variety at 0 °C is sometimes affected by the internal browning which is characteristic of low-temperature disorders.

Table 1 in Annex A gives the recommended temperatures for different varieties entering into international trade. In controlled-atmosphere storage, the storage temperature is sometimes higher, as shown in Table 2, Annex B.

3.2 Relative humidity

The optimal relative humidity for storage of apples is 90 %.

3.3 Air circulation

There should be a uniform distribution of air within the cold store, the rate of mixing being sufficient to keep the spatial differences in temperature and humidity within reasonable limits. Such devices as carbon filters and air washers, to remove volatile organic products of metabolism, are of doubtful value since such gases have no significant physiological effects at the recommended temperature of storage.

If the apples are being stored in air, and the cold store is sufficiently gas-tight for carbon dioxide to accumulate, some means of ventilation should be provided.

* Tests for the hardness of the flesh, and for the presence of starch, can also be used.