

Storage and Market Diseases of Fruit. VI

By

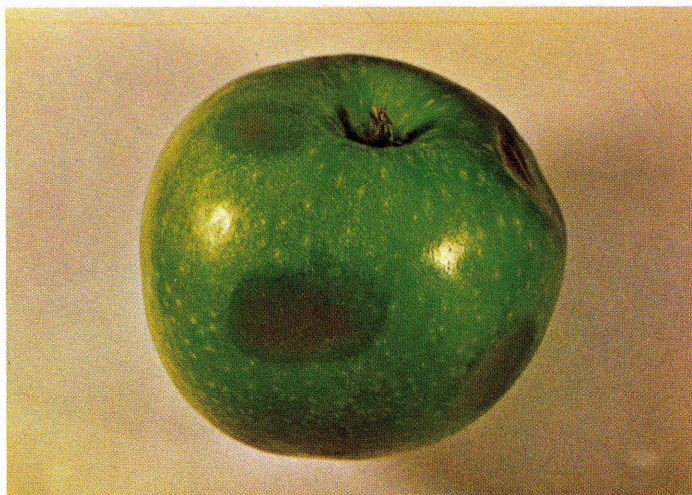
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FREEZING INJURY IN APPLES AND PEARS

The juice of apples and pears usually freezes at 28–29°F but rarely as high as 30°F, and fruit may become frozen if exposed to lower temperatures. If completely undisturbed, fruit may supercool to 1–2 degF below its freezing point without freezing, but when ice forms, e.g. if the supercooled fruit is jarred, its temperature quickly rises to the true freezing point. The severity of the freezing injury depends on both the temperature and the duration

of exposure to freezing temperatures. The formation of a small amount of ice in the tissue, commonly first in the core, causes little damage if the fruit is not handled while frozen; therefore the presence of ice does not necessarily mean freezing injury. Severely frozen fruit breaks down on thawing, but slightly frozen fruit can be thawed safely with little if any damage, provided that this is done slowly at a temperature of 32–36°F and the fruit is not jarred, even slightly.



Bruises in frozen Granny Smith apple—external after thawing.

Bruises in frozen Granny Smith apple—internal after thawing.



Apples

Slightly frozen apples may appear normal, or only slightly wrinkled externally, but they feel heavy and wooden, and there are ice crystals in the flesh. With more severe freezing the cells of the vascular bundles are first affected and, on thawing, injury may show as a brown discoloration of the 10 main vascular bundles and of the strands of vascular tissue through the flesh.

Severely frozen apples have a characteristically netted, wrinkled skin, they are reduced in size, and water-soaked flesh may show externally. On thawing, such fruit develops a moist flesh breakdown, initially pinkish and later brown, which is often similar to low-temperature breakdown. The surface of the fruit becomes discoloured in irregular areas and often appears more water-soaked.

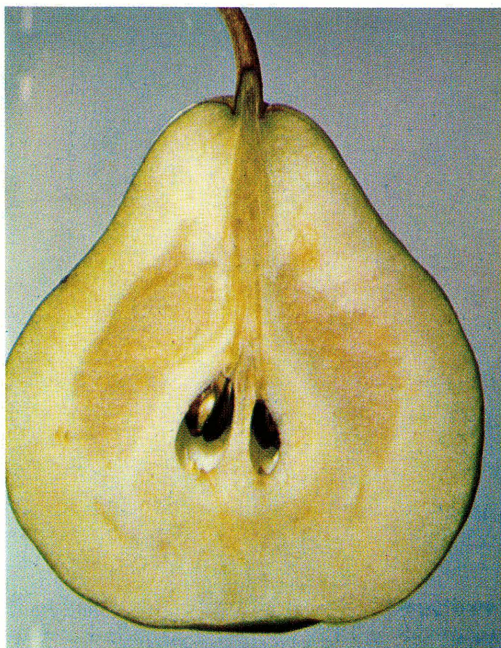
Bruising of frozen apples shows prominently after thawing as brown, conical sectors of damaged tissue, often noticeably sunken, or shiny and injected externally, and extending deeply into the flesh (Figs. 21, 22). The presence of ice crystals, injected flesh, discoloured vascular bundles, and the characteristic conical bruises help in the recognition of freezing injury.

Control

Freezing injury is controlled by keeping fruit temperatures above 29.5°F and by allowing slightly frozen fruit to remain undisturbed and to thaw slowly. Fruit in the cool store should never be stacked close to the cooling coils as this is a common cause of freezing.

Further reading

Rose, D. H., Wright, R. C., and Bratley, C. O. (1944).—Freezing injury of fruits and vegetables. U.S. Dep. Agric. Circ. No. 713.



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Moderate freezing injury in Packham's Triumph pear, after thawing.

Severe freezing injury in Packham's Triumph pear, after thawing.



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Pears

Frozen pears develop areas of translucent water-soaked tissue, first in the neck of the pear and later generally, but more commonly in the outer flesh. These frequently show externally as water-soaked areas on the skin. As in apples, ice crystals can be seen in the core cavity.

While slightly frozen pears will recover if not disturbed and if thawed slowly, more severely frozen fruit breaks down rapidly on thawing. At first the outer flesh may be water-soaked and colourless while the inner flesh becomes brown and often rather dry and pithy (Figs. 23, 24); in severe cases it cracks to produce cavities in the flesh. When the fruit is cut *transversely* the affected areas often show as rings, or partial rings, around the core.