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A Peculiar Freezing Trouble of Pears in Cold Storage

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A Peculiar Freezing Trouble of Pears in Cold Storage

By

HENRY HARTMAN

The particular trouble described here is fairly definite and positive in its symptoms. In all cases the specimens affected have a glassy, water-logged appearance from the outside. Upon cutting, it is found that water-logging is confined to certain fairly definite locations. Usually a layer of it is found beneath the epidermis, involving several layers of cells in the outer portion of the fleshy torus. Frequently, there is water-logged tissue within the core area. The remaining portion of the torus, for the most part, is dry and pithy and in advanced stages may crack open, leaving large, vacant spaces. Pears displaying the symptoms of this trouble often remain in an unchanged state for several weeks. They seem to be more or less resistant to decay and they do not undergo normal breakdown from overmaturity. In all cases, however, the fruit is inedible and has no commercial value.

History of the trouble. The present trouble first came to the attention of the author in Bartlett pears from the crop of 1926. These pears had been in cold storage for several weeks and a loss of approximately 5 percent occurred. In 1927, the trouble was again encountered in a lot of Washington Anjou pears that had been in storage for several months. The trouble again came to attention in 1928 when a loss of about 3 percent was reported in Bartlett pears held for canning purposes at Vancouver, Washington, and when a car of Washington Bartlett pears developed it upon arrival in Texas. In 1930, a shipment of Bartlett pears from Medford developed typical symptoms of the trouble after about six weeks of cold storage.

In all the foregoing cases the trouble was noted only after the fruit had been removed from cold storage and it was impossible to ascertain the exact conditions under which it had developed. All the early attempts to produce the trouble under known conditions resulted in failure. Neither holding the fruit in high concentrations of carbon dioxide nor freezing it for short periods of time produced any of the symptoms.

General methods. Experiments based on the theory that the trouble might be due to long-continued freezing in storage were conducted during the past season. Several boxes of Anjou pears of uniform grade and size were selected for the work. These were of three stages of maturity: (1) green and firm; (2) partly ripened; and (3) in prime condition, ready for eating. After arrangement into convenient lots, fruit of each stage of maturity was subjected to freezing temperatures of 27°, 23°, and 10° F. At intervals of forty-eight hours, one week, two weeks, four weeks, and six weeks, fruit from each lot was removed from the various cold rooms and was defrosted at a temperature of 32° F. Examinations of the fruit were made from time to time.

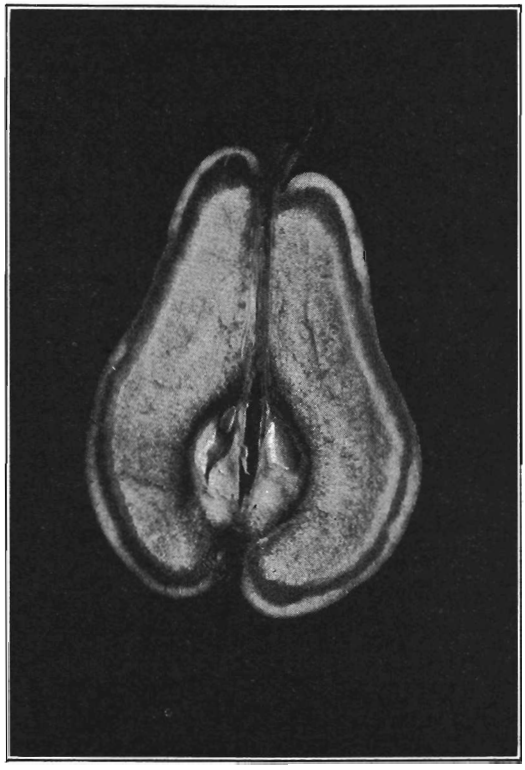

Figure 1. Typical form of the trouble in Bartlett pear.

PRESENTATION AND DISCUSSION OF RESULTS

Trouble produced by long-continued freezing. From the data obtained in these experiments (Tables I, II, and III) it is apparent that the trouble described in this Bulletin was definitely produced when the fruit remained frozen in storage for comparatively long periods at temperatures slightly below the freezing point of pears. When frozen for short periods—namely, forty-eight hours, one week, and two weeks—at temperatures of 27° and 23° F., the fruit usually recovered fairly well and did not develop the trouble. When frozen at these temperatures for periods of four weeks and six weeks, however, the fruit developed the trouble in typical form. This was true of all the fruit regardless of its degree of maturity at the beginning of the experiments. The fruit frozen at 10° F. all broke down immediately after thawing, the tissue becoming watery and discolored without developing the glassed or water-logged condition.

The data obtained here may well account for the occurrence of the trouble in past years. Pears are frequently held in cold storage for several weeks or several months. Even the Bartlett variety is often held under refrigeration for periods of six to eight weeks or longer. At the same time, freezing at temperatures slightly below the freezing point may occasionally occur even in well-managed storage plants. Especially is this true in cases where the direct-expansion system of refrigeration is used and where cold-air pockets may exist for some time without detection. The use of fans properly placed in the storage rooms goes a long way toward eliminating cold-air pockets.

Possibility of other causal agents. From the results of these experiments it cannot be assumed that long-continued freezing is the only cause of the trouble in question. While long-continued freezing did produce the trouble in typical form, the experiments did not completely dispose of the possibility of other causal agents.

SUMMARY AND CONCLUSIONS

(1) The particular trouble described here has occurred from time to time in pears that had been held in cold storage.

(2) The trouble is obviously physiological in character.

(3) All the early attempts to produce the trouble under known conditions resulted in failure.

(4) In the course of experiments conducted during the past season, the trouble was produced in typical form by long-continued freezing in storage, at temperatures slightly below the freezing point of pears.

(5) Long-continued freezing in storage may well account for the occurrence of the trouble in past years.

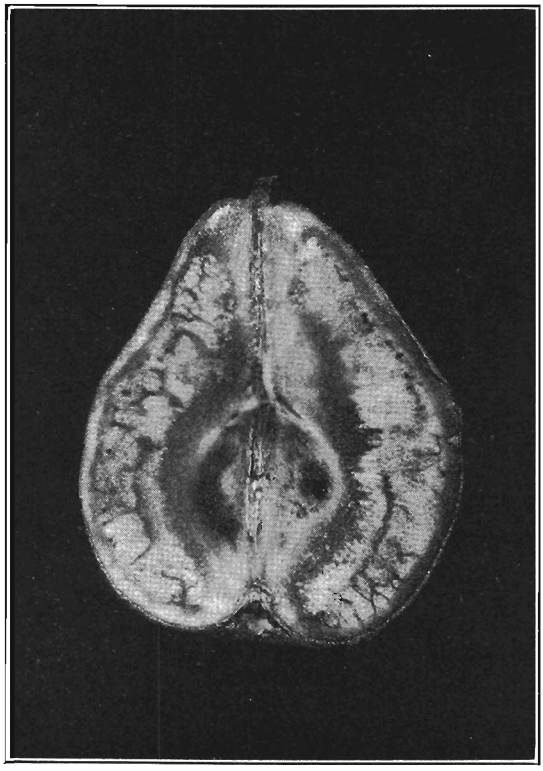

Figure 2. The trouble as found in pears of the Anjou variety.

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In carrying on these experiments the author received assistance from several persons and commercial concerns. Among those who gave valuable aid are J. F. Spalding of Southern Sales, Inc., who donated liberally of his time; the Union Terminal and Cold Storage Co. of New York City, which donated the storage space; and Southern Oregon Sales Inc., which donated the fruit used in the various tests.

TABLE I. AMOUNT OF THE TROUBLE DEVELOPED FOLLOWING FREEZING AT 27° F.

Length of freezing period	Lot number	Degree of maturity at beginning of experiment	Amount of trouble developed following thawing at 32° F.
48 hours	1	Ripe	None
	2	Partly ripe	None
	3	Firm, green	None
1 week	4	Ripe	None
	5	Partly ripe	None
	6	Firm, green	None
2 weeks	7	Ripe	None
	8	Partly ripe	None
	9	Firm, green	None
4 weeks	10	Ripe	Slight
	11	Partly ripe	Slight
	12	Firm, green	Slight
6 weeks	13	Ripe	Severe
	14	Partly ripe	Severe
	15	Firm, green	Severe

TABLE II. AMOUNT OF THE TROUBLE DEVELOPED FOLLOWING FREEZING AT 23° F.

Length of freezing period	Lot number	Degree of maturity at beginning of experiment	Amount of trouble developed following thawing at 32° F.
48 hours	1	Ripe	None
	2	Partly ripe	None
	3	Firm, green	None
1 week	4	Ripe	None
	5	Partly ripe	None
	6	Firm, green	None
2 weeks	7	Ripe	None
	8	Partly ripe	None
	9	Firm, green	None
4 weeks	10	Ripe	Slight
	11	Partly ripe	Slight
	12	Firm, green	Slight
6 weeks	13	Ripe	Severe
	14	Partly ripe	Severe
	15	Firm, green	Severe

TABLE III. AMOUNT OF THE TROUBLE DEVELOPED FOLLOWING FREEZING AT 10° F.

Length of freezing period	Lot number	Degree of maturity at beginning of experiment	Amount of trouble developed following thawing at 32° F.
48 hours	1	Ripe	None*
	2	Partly ripe	None
	3	Firm, green	None
1 week	4	Ripe	None
	5	Partly ripe	None
	6	Firm, green	None
2 weeks	7	Ripe	None
	8	Partly ripe	None
	9	Firm, green	None
4 weeks	10	Ripe	None
	11	Partly ripe	None
	12	Firm, green	None
6 weeks	13	Ripe	None
	14	Partly ripe	None
	15	Firm, green	None

*All the fruit from this series broke down completely after thawing.