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The Control of Core Break- down in Pears

By

HENRY HARTMAN



CORVALLIS, OREGON

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SUMMARY

(1) The development of core break-down is undoubtedly closely related to the time of picking. In all the tests and observations made, only the fruit harvested after its best picking time became affected.

(2) It is fairly certain that core break-down can be controlled by picking at the proper time and that this can be done without sacrifice of either tonnage or quality.

(3) Storage seems to have but little effect upon the development of core break-down. The amount of disease that ultimately develops does not seem to be influenced by either the kind of storage or the length of the storage period.

(4) The pressure tester, already described in the literature of this Station, again proved to be a reliable indicator of maturity in pears, and at this time appears to be the most effective weapon in the control of core break-down.

(5) Core break-down has generally been controlled and pears have developed good quality when picking has been done within the following ranges of pressure: Bartlett, 35 to 25 pounds; Comice 20 to 18 pounds; Anjou 24 to 19 pounds; Winter Nelis 28 to 24 pounds; Willamette Valley Bosc, 30 to 27 pounds; Rogue River Bosc, 24 to 20 pounds.

The Control of Core Break-down in Pears

By

HENRY HARTMAN

INTRODUCTION

To the investigator of plant diseases the physiological troubles of pome fruits present a unique and baffling problem. In spite of much careful research by qualified workers not a great deal has come to light concerning this group of abnormalities. It is true that the nature and control of apple scald and one or two similar disorders are now pretty well understood, but such functional troubles as bitter pit, corky core, dry rot, pear scald, Jonathan spot and others, must still be classed in the category of unsolved difficulties.

Nature of core break-down. As the name implies, core break-down is essentially a disease affecting the core area of pears. It is generally a storage trouble, making its appearance as the fruit approaches prime eating condition. In very severe cases, however, it may be found in fruits that are still firm and green on the outside. Affected specimens are occasionally found in fruits still attached to the tree. The disease may be confined to the region of the seed cavity (Fig. 1), or it may extend to the entire core and surrounding portions of the fleshy torus. In its incipient form, the disease is characterized by a soft and watery condition of the affected tissue. Later this is accompanied by a brownish or black discoloration, and a foul odor is generally present during the final stages. In severe cases rapid break-down of the entire fruit occurs.

Thus far, it has not been possible to attribute core break-down to the work of a living organism. Apparently it is a physiological trouble.

Terminology. Various names have been applied to this disease by different authors. Several of these, however, are inappropriate and should be discarded. The term "core rot" found in the literature, is undesirable since the disease has not been associated with a specific organism. Such terms as "internal browning," "brown heart,"² and "internal break-down,"³ have previously been applied to other physiological troubles of pome fruits, and hence cannot rightfully be used here. Of all the designations suggested, the name "core break-down" appears to be the most appropriate and is used throughout this bulletin.

Distribution. Although core break-down seems to be more serious in some localities than in others, the trouble is more or less common to all pear regions. Hedrick reports its presence in New York.⁴ Drain finds it in the pears from Massachusetts,⁵ while Overholser and Latimer recognize it in California.⁶ So far as the Pacific Northwest is concerned, no district where pears are raised is known to be entirely free from it.

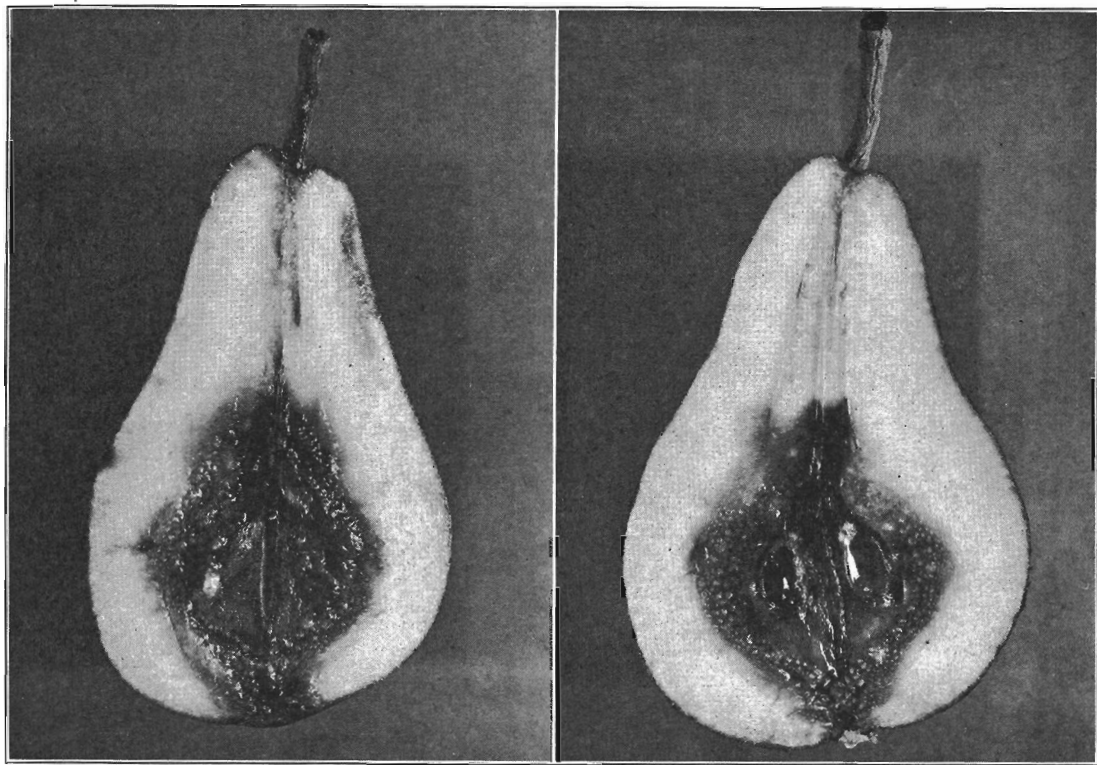


Fig. 1. Typical core break-down in Bosc pears.

Variety susceptibility. Apparently most varieties of pears are subject to core break-down. It is clear, however, that some sorts are much more susceptible than others. Hedrick mentions Clairgeau, Clapps Favorite, Doyenne Boussock, Early Harvest, Guyot, Jargonelle, Le Conte, Madeline, and Sudduth, as being readily susceptible in New York. Of the principal varieties grown in Oregon, Bosc, Comice, and Clapps Favorite are very frequently affected. Bartlett appears to be slightly less susceptible, while Anjou and Winter Nelis are fairly resistant.

Economic importance. As already indicated, core break-down usually makes its appearance as the fruit approaches prime condition. The average grower, therefore, rarely sees the effects of the disease and does not realize its importance. Although exact figures are not available, it is known that a heavy loss results from core break-down each year. Records show that the loss from this disease may vary from nothing to as much as 90 and 100 percent. The loss from this cause in the pears from a certain Willamette Valley orchard last year was approximately 80 percent. Cannerymen, in particular, frequently sustain heavy losses from this trouble.

EXPERIMENTAL

Casual observations have suggested that the degree of maturity which the fruit has attained when picked exerts considerable influence upon the development of core break-down, and that perhaps this trouble can be controlled by harvesting at the proper time. Even though this be true, however, considerable specific information is necessary before recommendations can be made. The range of susceptibility for the different varieties must be ascertained, the effects of time of picking on the dessert and keeping quality must be known, and a method for determining maturity must be perfected. Information relating to these phases was furnished by the experiments on pear harvesting and storage which have been in progress at the Oregon Experiment Station since 1917 and by field observations over a period of years in the various pear districts of the Pacific Northwest.

Time of picking in relation to core break-down. To gain more information on the relation of time of picking to the development of core break-down, experiments were conducted during the seasons of 1923 and 1924. Representative lots of Bartlett, Anjou, Comice, Bosc, and Winter Nelis were gathered at intervals of 3 to 5 days during the season of maturity. As many as 11 separate pickings were made in some cases. To reduce the probability of environmental difference as much as possible, all the lots of each variety were taken from a single tree. Pressure test determinations were made and the fruit of each lot was placed in common storage at a temperature of 66° F. and a relative humidity of 80 to 86 percent. It was found that all varieties ripened readily under these conditions. To simplify matters, calculations in each case were made on the basis of 100 specimens. Tables I, II, III, and IV give the data obtained in these tests.

Kind and manner of storage in relation to core break-down. In the course of the experiments on pear handling, various methods of storage

TABLE I. TIME OF PICKING IN RELATION TO THE DEVELOPMENT OF CORE BREAK-DOWN IN BARTLETT PEARS
(1923 results)

Lot number	Date of picking and storing	Pressure test	Temperature of storage room	Relative humidity of storage room	Date of prime condition	Number of days to attain prime condition	Amount of core break-down	Condition
1	8/18	lbs. 38.3	°F. 66°	% 80-86	9/2	15	0	Juicy, but slightly astringent, and lacking in sweetness. Waxy and slightly aromatic.
2	8/20	37.2	66°	80-86	9/3	14	0	Juicy, but slightly astringent and lacking in sweetness. Waxy and aromatic.
3	8/24	35.5	66°	80-86	9/6	13	0	Juicy and fairly sweet. Quality better than that of previous lots. Good waxy appearance. Aromatic.
4	8/29	33.0	66°	80-86	9/8	10	0	Juicy and sweet. Quality better than that of previous lots. Good waxy appearance. Aromatic.
5	9/1	31.5	66°	80-86	9/10	9	0	Juicy and sweet, with full Bartlett quality. Good waxy appearance. Aromatic.
6	9/7	28.1	66°	80-86	9/15	8	0	Juicy and sweet, with full Bartlett quality. Good waxy appearance. Aromatic.
7	9/11	26.0	66°	80-86	9/19	7	0	Slightly less juicy than previous lots, but of good quality. Good waxy appearance. Aromatic.
8	9/14	24.8	66°	80-86	9/20	6	5	Less juicy than previous lots. Sweet, but more or less insipid. Good waxy appearance. Aromatic. Core break-down not serious.
9	9/18	23.1	66°	80-86	9/22	4	60	More or less dry and insipid. Good waxy appearance. Aromatic. Core break-down quite serious. Not marketable as first-class fruit.

TABLE II. TIME OF PICKING IN RELATION TO THE DEVELOPMENT OF CORE BREAK-DOWN IN COMICE PEARS
(1923 results)

Lot number	Date of picking and storing	Pressure test	Temperature of storage room	Relative humidity of storage room	Date of prime condition	Number of days to attain prime condition	Amount of core break-down	Condition
		lbs.	°F.	%			%	
1	9/17	25.7	66°	80-86	11/9	53	0	Juicy but astringent and lacking in sweetness. Not waxy. Not aromatic. Not marketable as first-class fruit.
2	9/21	24.3	66°	80-86	11/8	46	0	Juicy but astringent and lacking in sweetness. Not waxy. Not aromatic. Not marketable as first-class fruit.
3	9/25	23.0	66°	80-86	11/7	43	0	Juicy, but still somewhat astringent and lacking in sweetness. Not waxy. Not aromatic. Quality still inferior. Not marketable as first-class fruit.
4	9/28	21.6	66°	80-86	11/7	41	0	Juicy, but still lacking in sweetness. Somewhat waxy. Slightly aromatic. Fair in quality.
5	10/1	19.1	66°	80-86	11/4	35	0	Juicy, sweet and of fairly good quality. Somewhat waxy. Slightly aromatic.
6	10/5	18.2	66°	80-86	11/3	28	0	Juicy and sweet, with full Comice quality. Good waxy appearance. Aromatic.
7	10/9	18.2	66°	80-86	11/3	25	5	Juicy and sweet, with full Comice quality. Good waxy appearance. Aromatic. Core break-down confined to seed cavities. Not serious.
8	10/13	17.3	66°	80-86	11/2	20	31	Less juicy than previous lots. Sweet and of fairly good quality. Core break-down somewhat serious. Not marketable as first-class fruit.
9	10/19	16.5	66°	80-86	11/1	13	100	Much less juicy than previous lots. Sweet, but more or less insipid. Core breakdown very pronounced. Fruit went down rapidly. Not marketable as first-class fruit.

TABLE III. TIME OF PICKING IN RELATION TO THE DEVELOPMENT OF CORE BREAK-DOWN IN BOSCH PEARS
(1923 results). (Willamette Valley Bosch)

Lot number	Date of picking and storing	Pressure test (pared specimens)	Temperature of storage room	Relative humidity of storage room	Date of prime condition	Number of days to attain prime condition	Amount of core break-down	Condition
		<i>lbs.</i>	<i>°F.</i>	<i>%</i>			<i>%</i>	
1	9/12	28.7	66°	80-86	10/1	18	0	Of good color and texture. Full Bosch quality. Held up well after maturity.
2	9/17	27.3	66°	80-86	10/9	22	0	Of good color and texture. Full Bosch quality. Held up well after maturity.
3	9/22	26.4	66°	80-86	10/11	19	30	Of good color and texture. Full Bosch quality. Core break-down confined largely to seed cavities. Not serious.
4	9/25	25.2	66°	80-86	10/13	18	63	Of good color. Core break-down much more pronounced. Quality affected somewhat.
5	9/29	23.9	66°	80-86	10/15	16	100	Of good color. Core break-down pronounced. Fruit went down rapidly after maturity. Not marketable as first-class fruit.
6	10/2	21.6	66°	80-86	10/17	15	100	Of good color. Core break-down pronounced. Fruit went down very rapidly. Not marketable.
7	10/5	20.3	66°	80-86	10/18	13	100	Core break-down very pronounced. Fruit broke down before full maturity was reached. Not marketable.
8	10/13	20.1	66°	80-86	10/24	11	100	Core break-down very pronounced. Fruit broke down before full maturity was reached. Not marketable.

TABLE IV. TIME OF PICKING IN RELATION TO THE DEVELOPMENT OF CORE BREAK-DOWN IN BOSCH PEARS
(1924 results.) (Willamette Valley Bosch)

Lot number	Date of picking and storing	Pressure test (pared specimens)	Temperature of storage room	Relative humidity of storage room	Date of prime condition	Number of days to attain prime condition	Amount of core break-down	Condition
		<i>lbs.</i>	<i>°F.</i>		<i>%</i>		<i>%</i>	
1	8/23	31.7	66°	80-86	9/13	21	0	Juicy, but lacking a little in sweetness and character. Of good color and texture. Held up well after maturity.
2	8/27	29.3	66°	80-86	9/18	21	0	Juicy and fairly sweet. Of good color and texture. Held up well after maturity.
3	8/30	28.8	66°	80-86	10/1	31	0	Juicy and sweet, with full Bosch quality. Of good color and texture. Held up well after maturity.
4	9/3	27.3	66°	80-86	10/3	30	0	Juicy and sweet, with full Bosch quality. Of good color and texture. Held up well after maturity.
5	9/8	26.0	66°	80-86	10/12	34	6	Juicy and sweet, with full Bosch quality. Of good color and texture. Held up well after maturity. Core break-down not objectionable.
6	9/12	25.1	66°	80-86	10/12	30	33	Juicy and sweet, with full Bosch quality, of good color and texture. Held up fairly well after maturity. Core break-down serious in a few specimens.
7	9/16	25.2	66°	80-86	10/13	27	62	Juicy and very sweet. Of good color and texture. Went down quite rapidly. Core break-down quite serious. Not marketable as first-class fruit.
8	9/20	24.0	66°	80-86	10/12	22	91	Less juicy than previous lots. Very sweet. Went down rapidly. Core break-down serious. Not marketable as first-class fruit.
9	9/25	21.6	66°	80-86	10/16	21	100	Less juicy than previous lots. Went down rapidly. Core break-down developed when pears were still firm on the outside. Not marketable.
10	9/30	20.1	66°	80-86	10/17	17	100	Core break-down developed when pears were still firm on the outside. Went down rapidly. Not marketable.
11	10/4	19.2	66°	80-86	10/19	15	100	Core break-down developed when pears were still firm on the outside. Went down very rapidly. Not marketable.

have been under observation for several years and considerable data bearing upon the relation of kind and manner of storage to core break-down have accrued. During the season of 1924, a rather comprehensive storage test of Willamette Valley Bosc was conducted, which also gave considerable information concerning this factor. In this test, three separate pickings were made, the first on September 2, the second on September 9, and the third on September 19. One-half of the fruit in each case was immediately placed in cold storage at a temperature of 32° F. and a relative humidity of 80 to 85 percent. The remaining portion of each picking was subjected to a "delay" of ten days and then was placed in cold storage with the other lots. Altogether 30 boxes of pears were used. Dating from the time of storage a box from each lot was removed at intervals of twenty-five days and allowed to ripen at a temperature of 66° F. and a relative humidity of 80 to 85 percent. The length of the cold storage period for each lot, in other words, varied from 25 to 125 days.

It was thought that a test of this nature might be of value because (1) it would afford a means of comparing core break-down development in cold and common storage, (2) it might yield information relating to the effects of immediate and delayed storage on the disease, and (3) it might show whether or not there is a relationship between the development of the disease and time in storage. Tables V and VI give the data obtained in this phase of the work.

CONCLUSIONS

From the data presented here and elsewhere, the following conclusions regarding the control of core break-down appear to be justified:

Core break-down can be controlled by picking at the proper time. Undoubtedly there is a close correlation between time of picking and the development of core break-down. In all the tests and observations made, only the fruit picked beyond the optimum picking time became affected to any extent. That picked at the beginning of the harvest period, or even past mid-season, remained practically free from the disease. Growers who habitually harvest their pears in due season seldom suffer loss from this cause. Not only can the disease be controlled by picking at the proper time, but it is certain that this can be done without sacrifice of either quality or tonnage.

Apparently, the later the time of picking the more pronounced the disease becomes. Pears picked just at the border line of over-maturity usually show only a trace of core break-down and this only as they become fully ripe. Those picked very late, on the other hand, become affected while still green on the outside, the trouble soon spreading to the entire core area. Early break-down of the specimens usually occurs in such cases.

Length of the proper picking season varies. The length of the proper picking season for pears, that is, the length of the period during which pears can be picked without danger of immaturity at one extreme and core break-down at the other, varies considerably with different varieties and with different localities. In all cases, however, the season appears to be sufficiently long to afford ample time for harvesting.

TABLE V. THE RELATION OF TIME OF PICKING AND TIME IN COLD STORAGE TO THE DEVELOPMENT OF CORE
BREAK-DOWN IN BOSCH PEARS
(Immediate cold storage) (Willamette Valley Bosch)

Lot number	Pressure test (pared specimens)	Date of picking	Date of cold storage	Box number	Date of removal from cold storage	Number of days in cold storage	Date of prime condition	Number of days to attain prime condition out of cold storage	Amount of core break-down
	<i>lbs.</i>								<i>%</i>
1	27.7	9/2	9/2	1	9/26	25	10/9	13	0
				2	10/21	50	11/7	17	0
				3	11/15	75	12/3	18	0
				4	12/10	100	12/22	12	0
				5	1/4	125	1/15	11	0
2	25.1	9/9	9/9	6	10/4	25	10/19	14	49
				7	10/29	50	11/19	20	60
				8	11/25	75	12/10	15	52
				9	12/17	100	1/5	19	46
				10	1/11	125	1/20	9	54
3	23.4	9/19	9/19	11	10/14	25	10/25	11	100
				12	11/8	50	11/27	19	98
				13	12/3	75	12/19	16	100
				14	12/28	100	1/10	13	96
				15	1/22	125	2/5	14	97

TABLE VI. THE RELATION OF TIME OF PICKING AND TIME IN COLD STORAGE TO THE DEVELOPMENT OF CORE
BREAK-DOWN IN BOSC PEARS
(Delayed cold storage) (Willamette Valley Bosc)

Lot number	Pressure test (pared specimens)	Date of picking	Date of cold storage	Box number	Date of removal from cold storage	Number of days in cold storage	Date of prime condition	Number of days to attain prime condition out of cold storage	Amount of core break-down
	<i>lbs.</i>								<i>%</i>
1	27.7	9/2	9/12	1	10/6	25	10/16	10	0
				2	11/1	50	11/24	24	0
				3	11/26	75	12/9	13	0
				4	12/22	100	1/5	14	0
				5	1/15	125	1/25	10	0
2	25.1	9/9	9/19	6	10/15	25	10/25	10	32
				7	11/8	50	11/27	19	46
				8	12/3	75	12/15	12	55
				9	12/28	100	1/5	8	51
				10	1/22	125	2/2	11	48
3	23.4	9/19	9/29	11	10/24	25	11/4	11	100
				12	11/19	50	12/3	14	96
				13	12/13	75	12/22	9	100
				14	1/7	100	1/17	10	100
				15	2/2	125	2/8	6	100

The length of the proper picking season for any given lot of Bartlett grown in the Willamette Valley can be set conservatively at 15 to 18 days. For the Rogue River Valley and for some of the districts east of the Cascade Mountains the season can possibly be extended a little beyond these figures. The range of picking dates for Anjou from the Willamette Valley probably varies between 12 to 16 days, that of Winter Nelis between 14 and 18 days, that of Comice and Bosc between 6 and 8 days. As in the case of Bartlett, the picking season for these winter sorts when grown east of the mountains or in the southern part of the state can perhaps be extended a few days. Comice and Bosc evidently have a comparatively short harvesting period. This, in all probability, accounts for the common occurrence of core break-down in these varieties.

Core break-down is not influenced by storage. The amount of disease that ultimately develops does not seem to be influenced by either the kind or manner of storage. In the present experiments the rate of development was practically the same whether the fruit was kept in cold or in common storage, whether the storage period was long or short, or whether storage was immediate or delayed.

Calendar dates are not reliable indicators of maturity. That calendar dates alone are not reliable indicators of maturity in pears is shown by the results of these investigations. As indicated by ripening dates, for example, the season of 1924 was generally from 10 to 12 days earlier than the season of 1923. Many growers, however, were not fully aware of this fact and records show that in many cases the pear crop was harvested on approximately the same dates during both seasons. This may well account for the fact that core break-down was much more common in 1924 than in 1923. Again, the proper time of picking may vary from year to year because of the amount and nature of the crop. Experiments have shown that the proper picking season during heavy crop years may be several days in advance of that in light crop years.⁸ The vigor of the trees also may influence maturity in some cases. Maturity, too, may vary considerably in the same locality because of the slight differences in the situation of the orchard. It is a well-known fact, for example, that the pears from the river bottoms of the Willamette Valley ripen several days ahead of those from the hill districts.

Pressure test is effective in control of core break-down. The pressure tester already described in the literature of this Station again proved to be a fairly reliable indicator of maturity in pears and at this time appears to be the most effective weapon in the control of core break-down.^{7, 8} In fact, core break-down has practically ceased to be a factor where the pressure tester has been intelligently applied.

Experimental data as well as practical experience show that in the case of Bartlett no core break-down has been encountered when harvesting has been done at pressures ranging from 35 to 25 pounds. This apparently holds true for the principal pear districts of the state. Anjou has remained free from core break-down and has yielded fruit of good quality when picked at pressures varying between 24 and 19 pounds. Comice has given fairly satisfactory results at pressures between 20 and 18 pounds, and Winter Nelis has been successfully harvested at pressures between 28 and 24 pounds on clear skinned specimens. Bosc in the Rogue River Valley can generally be picked within a pressure range of

24 to 20 pounds. Willamette Valley Bosc, on the other hand, are generally firmer in texture and must be picked at pressures that are considerably higher. Again, Bosc from this region are usually covered with russet of varying intensity, and experience has shown that it is best to pare the specimens prior to making the pressure readings. Taking these factors into account, the range of suitable picking pressures for Willamette Valley Bosc seems to be between 30 and 27 pounds. Fig. 2 shows in graphic form the recommended pressures for the different varieties.

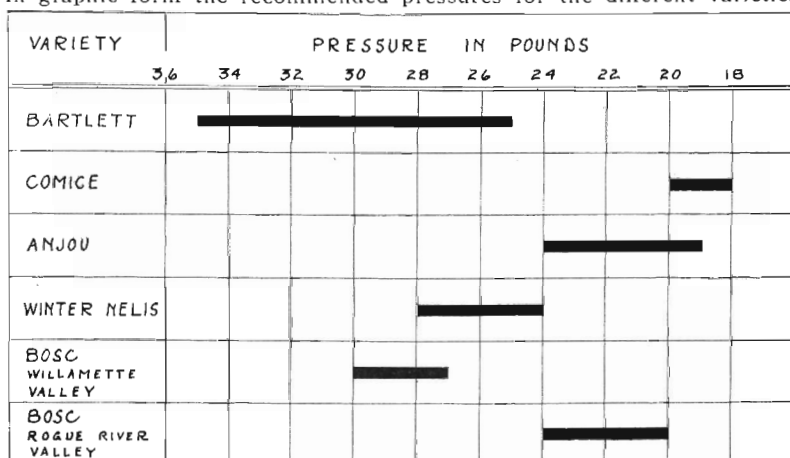


Fig. 2. Proper picking pressures for varieties of pears. Core break-down has practically ceased to be a factor where the pressure tester has been intelligently applied.

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