

Lessons From the 1937 Freeze

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Talk given October 29, 1937, Eighth Annual Avocado Growers Institute

W. G. Steele: I know you are all anxious to hear from Mr. Young and he is here now; he is very busy—this being his busiest season and he has to get away as soon as possible so we are going to have his illustrated talk first. I take great pleasure in introducing Mr. Floyd D. Young of Pomona.

Floyd D. Young: Ladies and Gentlemen: I am sorry that I do have to rush through this so rapidly. We just got through testing 20,000 thermometers and I am soon leaving for various districts, where we are holding conferences. It is quite necessary that we make every minute count at this time of year especially.

The longest meteorological records in the world show that there has been no perceptible progressive change in climate during the period for which records have been maintained. In most localities the records are so short that extremes of high and low temperature may be expected to break all past records at comparatively frequent intervals. California weather records show freezes have occurred on the average every ten to fifteen years in the past, and there is every reason to believe that they will continue to occur in the future.

We attempt to make arbitrary differentiation between frosts and freezes, but they have so much in common it is often difficult to know just where to draw the line between them. Frosts are more localized than freezes, and are primarily due to radiation loss of heat to a clear sky. They are characterized by low temperature ceilings, little surface air movement after sundown, and relatively large differences in temperature between high and low ground.

CAUSES OF FREEZES

Freezes are primarily due to influx of great masses of unusually cold air from the north or northeast, although radiation loss of heat to the sky at night also has a great deal to do with their severity. Freezes are characterized by relatively high ceilings, little or no difference in temperature between high and low ground, and sometimes considerable wind. Low temperature periods which occurred in southern California in 1913, 1922, 1924 and 1937 can be classified as freezes, while the cold periods of 1918 can be classified as exceptionally severe frosts.

The freeze of January, 1937 unquestionably was more severe in southern California than any previous cold period that has occurred since systematic records were begun.

Surprisingly little dependable data are available, even on the 1913 freeze, but comparisons between 1913 and 1937 low temperature figures for the few localities where reasonably accurate records were kept in 1913 show definitely that the 1937 freeze was more severe except in areas in which 1937 temperatures were materially affected by mass orchard heating practiced on a large scale. The table below gives minimum temperatures for various points in southern California for 1913, 1922 and 1937.

Because of the fact that the records were not all obtained at the same points in the different years, they are not strictly comparable, but they show in a general way the difference in severity of the different winters.

COMPARISON OF THREE MAJOR FREEZES

	1913	1922	1937
Calexico	21°	23°	15°
Indio	16°	23°	14°
Corona .....	.....	24°	20.5°
Riverside	21°	19°	20°
Redlands	18°	19°	16°
Highgrove .....	.....	20°	19°
Fontana .....	.....	23°	16.5°
Claremont	19°	20°	22°
Pomona	18°	18°	20.5°
Yorba Linda .....	.....	26°	24°
Santa Ana .....	.....	25°	22°

From the standpoint of the number of cold nights, the greater severity of the 1937 season is even more striking. The 1913 freeze lasted three nights in some localities, in others only one. The 1922 freeze lasted a maximum of five nights in the coldest localities, but in some others only one. The second January freeze alone in 1937 lasted seven consecutive nights, and in some of the coldest spots firing was necessary for a total of 29 nights during the winter, with quite general and heavy firing on 18 nights.

1922 AND 1937 COMPARISONS

The contrast between the 1922 and 1937 freezes was marked in other ways, particularly in the character of the weather preceding and following the cold periods. In 1922 there was practically no cold weather up to the time the freeze began, and frequent warm rains kept the trees in a tender growing condition. When the freeze began the trees could not have been in a worse condition to withstand low temperatures, and the resulting damage was correspondingly heavy. Immediately after the freeze day temperatures rose to 75°, which, with clear skies and warm sunshine, resulted in a condition least conducive to recovery of either trees or fruit injured by low temperatures. One immediate effect was an extremely heavy drop of fruit from the trees.

In 1937 frequent light to moderate frosts early in the season hardened the trees and greatly lessened their susceptibility to low temperature damage. The temperature

dropped below 32° in the colder citrus districts every day during the month of January except the 5th and 6th. Following the freezes the sky remained cloudy most of the time, with frequent rains. Day temperatures were below 60° from December 23 to the end of January.

CAUSES OF FREEZES

Speaking very generally, southern California's freezes result from the unequal heating of the earth's surface between the equator and the pole. Warm air masses in middle latitudes tend to move northward and cold air masses at high latitudes tend to move southward in the northern hemisphere. The rotation of the earth on its axis complicates matters by deflecting moving objects toward the right in the northern hemisphere, preventing a simple direct interchange of air between the equatorial regions and the polar regions. During long arctic nights in winter cooling by radiation goes on continuously, with but little heat received from the sun in return. Cold air masses build up in the Arctic regions and finally start southward or southeastward. During most winters these bursts of frigid air move southeastward and miss southern California entirely, but at long intervals they move almost directly southward and California shivers. The severity of the freeze depends on the temperature of the cold air mass when it leaves its source and on the rapidity with which it moves southward. If it moves slowly it may warm up sufficiently on its journey to California to deprive the cold wave of much of its severity.

From the standpoint of the weather map, freezes all result from the same general pattern of barometric pressure. They begin with an intensive high pressure area in Alaska and western Canada, accompanied by unusually low temperatures, and a well developed low pressure area over Washington and Oregon, or even further west over the Pacific Ocean. The low pressure area moves southward over California and Nevada and then eastward along the Mexican border until it weakens and practically disappears due to filling up with relatively cold air. The high pressure area spreads southward in its wake, arriving finally over the Plateau Region, where it usually remains until it also dwindles away due to local warming. Lantern slides show the great similarity between weather charts and the interaction between the warm and cold masses in the 1922 and the 1937 freezes.

FUEL STORAGE INADEQUATE

Our first orchard heater survey, made in 1926, showed definitely that orchard heater fuel storage capacity in the citrus districts was far below safety requirements should a freeze occur. Everything humanly possible was done to bring this to the attention of growers, packing house associations and marketing agencies. A great many oil storage tanks were installed at packing houses and in groves as a result, but later surveys showed field oil storage capacity was still much below requirements to carry through a major freeze.

Attention was frequently called during the past three years to the fact that a major freeze was considerably overdue and that fuel storage should be kept up to top

capacity. Despite these warnings most growers and associations had relatively little fuel on hand at the time the first warning of the freeze of January 8th to 10th went out. A preliminary warning on January 4th made possible the mobilization of all agencies connected with the furnishing and transporting of fuel to the citrus districts, and most oil storage tanks were filled before the freeze began. One railroad started 150 oil tank cars southward from the San Francisco Bay district immediately on receipt of the first warning, and soon afterward tank cars were brought to California from as far east as Texas. Prior to the second freeze train crews were brought to California from wherever they could be spared as far east as Texas, to handle the many short oil trains carrying fuel for orchard heating.

The effects of mass heating were very striking. The normally colder districts, with a large percentage of the groves equipped with orchard heaters, were among the warmer during the freeze. The temperature in some of these districts was raised at least 5° in all unheated groves, and in hundreds of cases groves without heaters scattered through large heated areas came through without damage either to fruit or trees.

Interesting slides were shown, while Mr. Young gave further explanatory remarks in connection with frosts and freezes.

Has anyone any questions?

Q. In your radio forecasts, Mr. Young, you mention Garden Grove, Orange and then Tustin and you don't call Santa Ana at night—why?

A. Well, we have taken up quite a good deal of radio time as it is. We started in with a very small list and all these other stations have been forced on us by public pressure and we resist that as much as we can. We don't want to take up too much time. Another factor—our Santa Ana station is usually very warm and there is no necessity for broadcasting that as much as some others.

WRIGLEY MADE BROADCASTS POSSIBLE

Someone asked me before I came down here, what the broadcasting arrangements were for this year. KNX, beginning December 1, will announce for us in the same manner as last year—8 o'clock Monday to Friday, inclusive, and 8:15 on Saturday and Sunday but there will be no remote control until December 1st, but they have agreed that in case of any danger we can telephone a short statement and the announcer will broadcast that at 8 o'clock. I might say it has been difficult for KNX; they are now tied up with Columbia and all the evening time is sold for the entire winter. It was necessary for them, in order to broadcast our forecasts, to take the Wrigley program five nights a week, cut KNX, and put it on again at 9:30, as I understand it; broadcasting a playlet it was necessary for them to bring musicians and bring them back at 9:30 and re-broadcast. I also got a quotation of what they charge and for 15 minutes at that time of night the charge is \$700.00—so in addition to giving us the \$700.00 per night, they were also bringing actors to re-broadcast this particular program at great expense. We really should all appreciate the trouble which the Columbia people and Wrigley people have taken to make that broadcast possible. I think we owe Mr. Wrigley in particular a debt of gratitude. He helped us out last winter too. I would suggest that any of you who make

use of this broadcast, write a personal letter to KNX and mention the fact that we appreciate this service.

Guy Steele: We certainly want to thank you, Mr. Young, for your very fine talk.