

feet for the last seven Februaries at that station. At Piedra on the Kings River the average stage was 4.5 feet, the lowest since 1904 and slightly lower than the February record for that year.

FIGHTING THE BIG FREEZE.¹

By J. E. ADAMSON, Cooperative Observer, Pomona, Cal.

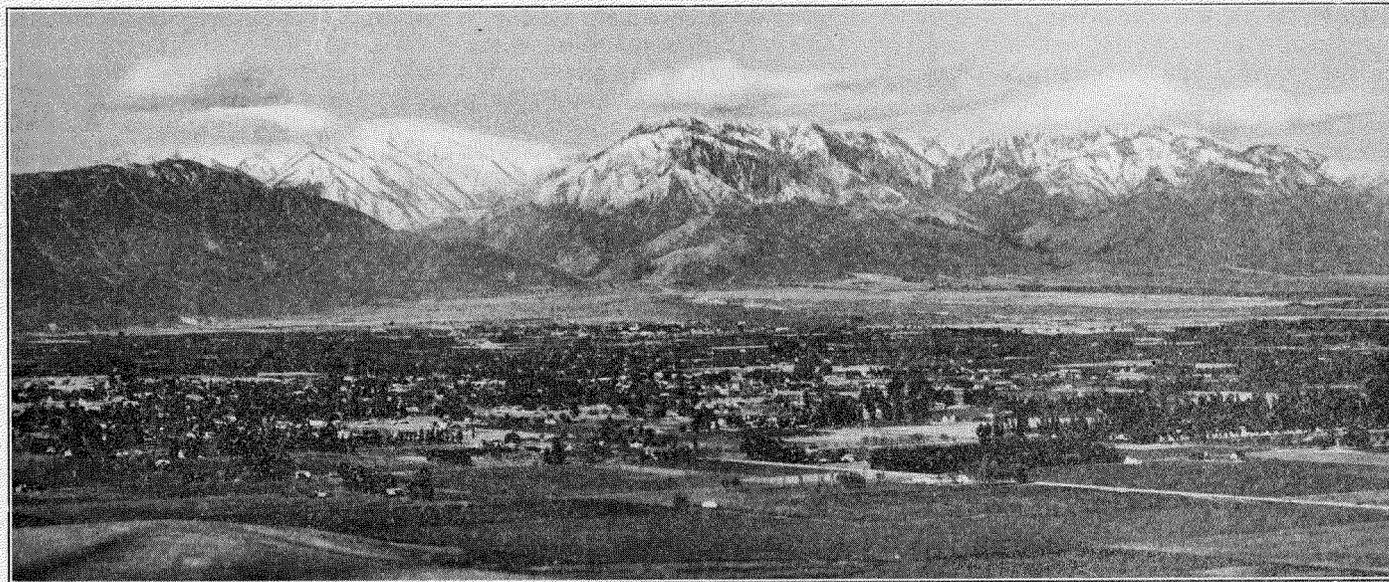
When one undertakes to tell of the recent frost fight in Pomona, the desire to describe it as one would describe a battle between contending armies on the field is almost irresistible. There is the same tense feeling among the recruits in the fight; as the time of the battle draws near, the heart breaks at failures to hold safely some outpost; the same hard struggles at corners and along roadways. There were the scouts with reports to headquarters of the near approach of the dreaded enemy at some point more weak than others, and the orders to some part of the long front to open fire, then the gradual spread of the firing until before long the red glare extends along the whole line.

The very preparation for this fight was like a revolt of a downtrodden people. This same enemy had for many years made almost annual visits to the southland and

In the final results it would be hard to find any one factor which it could be said was the most effective in saving, almost unscathed, thousands of beautiful trees and a large proportion of a bounteous crop of fruit, unless it might be the dominating spirit of perseverance on the part of the fighters, toiling on without rest for four days and nights.

Many and varied were the heaters used, from the more modern type with shore smokestacks and dampers to control and aid combustion, down the line to the cruder kinds of the past, to the use even of empty powder cans with tops cut out. The latter kinds, of course, made, as well as heat, a dense volume of smoke and gave off large quantities of soot. The other well-known forms, the old-style Bolton and the Hamilton reservoir heaters, were in evidence, but by far the greatest number in use were improved Bolton and the California 3-gallon heaters. The latter was the heater made in large quantities for the California Fruit Growers' Exchange. Both these heaters did splendid service, and made much less smoke and soot than the older and more crude forms.

Some of the Griffiths' smudge fuel, a mixture of mill shavings and crude oil, was used, but not to any great extent in this vicinity.



View of Pomona district and its mountain environment.

taken toll from the tillers of the soil. Not always in the same place, sometimes only making a slight demand, but always feared.

Small groups here and there for many years offered resistance, but in a way so puny and isolated that it seemed to come to naught. But out of these attempts came a gradual awakening of the people, so that the fight became more and more centralized from year to year, and when the danger time came this past fall there were not a few, but a large body of men, near Pomona, organized for a concerted rebellion, and busy getting in supplies of ammunition in the shape of oil, and guns in the way of various kinds of pots in which to burn the oil, and other equipment such as torches and tank wagons. Headquarters had been established earlier in the year, and a chief of staff appointed; instructions were ready for the ones unfamiliar with the work in hand; nothing was to stand in the way of a winning fight.

The lighting was done mostly by the use of a simple device designed by the writer some years ago, and known as the Adamson torch. It is extremely simple and it is not hard to light 250 to 300 heaters per hour, and an active man can do better.

The oil used in the heaters was to be what is termed "slop distillate," and to contain only a small amount of asphaltum. It was soon found that when such large quantities were called for on short notice, it was not to be had in any specified grade, so it turned out that oils of much lower gravity and containing 25 per cent and over of asphaltum were shipped and burned.

The oils, as they average up in price for the different grades used, will cost the grower about \$1.10 per barrel of 42 gallons. This includes the purchase price, the freight, the cost of handling, the building of tanks, handling equipment at the railroad tracks, also all the expenses of the temperature patrol service operated for the benefit of the frost fighters.

Many of the growers placed complete equipment of 100 heaters per acre; the average was not above 75 per acre

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for the entire district. The best equipped had less trouble holding the temperature than did those with the fewer heaters or those with the old-style small heaters, but at best it was a hard fight, and some gave up in despair before it was ended. Small isolated pieces were particularly hard to hold in such trying times, but in some cases were carried through in fine shape. But wherever there was a large body of fired orchards together, the work was not only easier but more noticeably perfect.

Now to a description of the fight, to tell how a district that was once pointed at as the frosty part of its immediate neighborhood is now in such good condition, while all around in more favored districts are to be found such evidences of frost as were never thought to be possible.

Taking the map of the Pomona district, it will be seen that the city lies on the slope from the Sierra Madre mountains, in a sort of basin formed by two ranges of low hills to the south and west, with the fruit-growing lands shouldering against the residence districts on the north, east, and west.

There are about 600 acres to the west, 150 being lemons and the balance in oranges. The acreage to the north and east is almost all in oranges, tributary to packing houses at Pomona, Claremont, and Narod.

Nearly all of the acreage in the west end was fired and about 2,000 acres to the north and east. A large area of orange lands to the north, reaching nearly to the base of the mountains, has always been thought frostless and was not equipped, so our story deals only with the part in the immediate vicinity of Pomona, and recognized as subject to frost.

This district was laid out in six general groups, to facilitate communication with the growers when the temperature should fall near the danger point in any part of the field. These six groups were placed under three watchmen or scouts, with headquarters at the Park Avenue packing house of the Pomona Fruit Growers' Exchange, where a complete record of the reports was made for future reference.

Each of these scouts took readings from a number of thermometers, the largest route having 27 and the smallest 21, each station bearing a number. These routes averaged about 11 miles from the headquarters and return, the rounds being made on motorcycles. Each man carried a card, ruled for as many as 30 stations and 8 trips, but no more than four trips were ever made in one night, as it was found that either the fight started or was called off before that many trips were made.

In the office there was a map showing all the region covered, with the orchards to be fired colored red, and all thermometer stations marked with a small nail, on which was hung the number of the station and the temperature as it was reported by the scouts.

Arrangements for calling the growers had been made with the telephone company, and a full list of the names of those who were to fight with heater and torch against the grim and silent enemy was supplied the operators at the telephone exchange, with the lists numbered from 1 to 6 to correspond with the map of the valley at headquarters.

The plan as worked out was that "central" would ring five bells on the line of a subscriber, and when the grower answered it by giving his name and number, he would hang up, knowing what the call was for, without further explanation.

The first sign of danger came on the night of December 2, when it began to look bad about midnight. The scouts made two rounds of the valley, but nothing serious developed. Again on the night of the 3d, with the same

results. But on the night of the 5th it was necessary to call the lemon growers at 10 p. m., and four sections of the orange growers three hours later. Temperatures did not go very low, but it must be remembered that there had not been any cold weather, and the trees were quite tender. Then, too, it seemed best to have the fighters try their mettle for the first time when there was not any serious danger. Several lost their heads and fired before they were called, and many of them were impatient for the time to come.

The scouts were out a total of 17 nights in December, sometimes finding danger on the north and west, and then again on the north and east; sometimes along the whole front from the extreme southwest around the north to the extreme southeast. The worst nights in December were from the 21st to the 27th.

The new year was reached with the fighters turned into veterans and confident in their powers to combat the forces of Jack Frost. They were the victors in some pretty stiff fights during the month, and a general feeling seemed to prevail that there would be no more of it. Indeed, had not some of the weatherwise solemnly assured us that there would be no severe weather this winter, anyway, because "It never freezes two years in succession"; also, that "It can't freeze when there is no snow on the mountains"? Evidently there was snow somewhere else.

As though in a final supreme effort to crush out the opposition forever, the enemy rallied to the assault on the afternoon of January 4, the first omen of trouble showing in an exceptionally low barometer. That night high winds prevailed and low temperatures were found only the last hours of the night, for a short time. The night of the 5th came down cold and without much to hope for but hard fighting. The wind came up about 2 a. m., of the 6th, but without the rise of temperature which usually comes with the wind. Instead, the temperature stood steadily at 29°, with the wind blowing a gale. A lull in the wind about 6 a. m., brought the temperature down to 25° for a short time. The maximum for the 6th was only 43°, and by 6 p. m., it was 30°. No scouts were needed that night, as the fight was on before dark in some places. The scouts made three rounds to get data for record, and developed the most unusual thing of the whole freeze. The upper levels were showing the dangerously low temperatures earlier than the lower levels. There seemed to be a vast blanket of frigid air, slowly but surely settling over the valleys of the south, and all the organization of the Pomona growers was needed to keep safe the precious crops.

At one of the points where the heaviest fighting occurred the owners had six men and a team in the field, and when the fight got to the hardest abandoned a part of the orchard and concentrated the effort on 6 acres of lemons. Other points there were where the fighters lost heart and gave up, not even refilling the pots for the fight the next night.

One of the successful fighters tells me he will have installed double equipment next year, so the victory will be easier and more sure. Most of them are satisfied with the results and intend to be better prepared another time. There is a general feeling in favor of the 5-gallon can for a large part of the storage, having a can near each heater so there will be no delay in replenishing the fire at a critical time.

At some places along the frontier there can be seen the evidence of the fierce struggle of the two elements, fire and frost. The enemy was not easily turned back,

as the trees show. The extreme windward side bears silent testimony to the danger threatened. The leaves in many places look as though a fire had been built near by, but as you get in a few rows there is to be seen a marked difference in the appearance of the foliage, until as a distance of 100 feet or more is reached there is almost complete immunity.

One disheartening aspect of the fight was the apparent effect on the trees of the extreme dry condition of the air. The relative humidity was for several days about 10 per cent, and the trees looked so withered that the fired groves looked as bad as the unfired. This gave rise to the claim that there was no use in trying to fight. However, on the 9th there came a light rain followed by showers for two days that immediately brought back the fresh green of the fired groves, while the unfired stayed curled.

The victory was won. We have now had time to look about us and realize that the labor begun five years ago and culminating in the splendid organization of this

year was bearing fruit many hundredfold, and that with the experience of the past there has been built up a confidence in the power of fire to combat frost, even at the risk of having to "warm up all outside." Improvements in methods will come as a matter of course, even as there is to be seen a vast difference between the crude oil pots of the past and the improved heaters of the present. Some improvements are even now being offered to offset the obnoxious soot factor, and the orchard heating of the future will be free from many of the most trying elements of the past work. The greatest lesson of all to be drawn from the Pomona fight is the value of cooperation and consolidation. Nothing else could have saved the day. If each had gone his own way, with no effort to bring his neighbor into the fight so that a mighty unit could be pitted against the common enemy, it would have been a dismal failure, as many a derelict of orchard heating stands to-day a mute witness to the futility of individual effort.