

Effects of the Freeze on the Avocado

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Carter Barrett, President: I am very happy this morning that we again have Dr. Coit with us. Last year, for the first time in many years, Dr. Coit was absent through necessity. He is always a helpful figure at these meetings and only illness would keep him from being with us. His absence last year was a great disappointment to us. We are indeed happy that Dr. Coit is back in good health and able to present his own vigorous views on phases of the emergency our industry experienced this winter. He will present his paper on "Effects of the Freeze On The Avocado."

Dr. J. E. Coit: Mr. President, Ladies and Gentlemen: The subject of this paper is not of my own selection. It was handed to me and I have done with it what I could.

The primary effect of the cold on avocado trees was defoliation with killing back of blossoms, twigs, limbs, and in some cases, even the trunks. The amount of injury, or the degree of reduction in bearing capacity, varied widely according to locality, variety, age, health, and condition as to dormancy.

EFFECT ON TREES

On coastal terraces immediately adjacent to the sea, damage was relatively slight. On central and upper parts of broad gently sloping alluvial fans, damage was more severe. At considerable elevations on rolling or steeply sloping foothills, damage was either light or entirely lacking. On raised benches and fans further from the sea, at elevations from 1500 to 2000 feet in the vicinity of high mountains, injury was severe, due chiefly to excessive altitude. Within each of these zones the degree of cold and resulting injury often varied over very short distances, being governed by air currents occasioned largely by local topography. This is indeed a complex picture, but it may be said that the general pattern of cold intensity in January, 1937, was substantially similar to that of 1913.

The effects of the freeze varied widely with the variety. The least damage was suffered by the pure Mexican type, while Fuerte and Puebla were intermediate as to injury, and pure Guatemalans, such as Anaheim, Dickinson, and Queen, were the hardest hit.

The effects of the freeze varied with the age of the trees, being less the older and larger the trees. Also trees in a healthy, vigorous condition on well sub-drained soils stood the cold better than weak or sickly trees on very heavy or poorly sub-drained soils. The condition of the trees as to dormancy was also found to be a most important factor. This freeze came after a period of sustained cold weather had made avocado trees in most places as dormant as they could well be under California conditions. The trees at this

time possessed unusual powers of endurance. I have heard many expressions of amazement at the degree of cold, as measured by thermometers, which was endured by some of our avocado trees. If this freeze had come after a period of warm growing winter weather, such as we often have, I am afraid that we would not have had many trees left.

One effect of the freeze on the trunks of the trees was a browning of the inner bark in patches and also a browning of the cambium itself. In connection with top-grafting trees the question was immediately asked, "Just how brown may the cambium be without ruining the prospects of scions inserted into it?" Lacking information, this question could not be answered with any accuracy. However, as a great deal of this work has recently been done, an abundant answer should be available before the close of this season.

EFFECTS ON FRUIT

Effects of the freeze on the fruit varied according to the degree of cold. At temperatures below 20 degrees the effect was to freeze the fruit solidly to the center, after which it turned black, dried out, and remained firmly attached to the dead twigs. With less exposure to the Fuerte variety only the surface of the fruit and the stems were frozen, after which the fruit dropped. A still less exposure turned the bark of the stem brown, leaving the interior or woody fibre of the stem normal. Under such conditions the fruit did not drop immediately, and it was then believed by many growers that such fruit would hang until the market revived. Such were doomed to disappointment, for after a heavy rainstorm, such fruit dropped rapidly and almost completely. A large amount was salvaged, and though often showing a darkening of interior fibres, was consumed in large volume and with satisfaction.

Later in the season it developed that certain Fuerte fruits which had been severely chilled, but showed no outward sign of damage, were seriously discolored in the interior. This defect proved almost impossible to grade against and subsequently played an important role in postponing the much hoped for strengthening of the market. The difficulty of accurately grading slightly frosted Fuertes and the rapid development of modified official standardization requirements will be more adequately covered by Mr. Hodgkin at another place on this program.

EFFECTS ON THE BLOSSOMS

On account of the above mentioned dormancy, but few trees were in bloom at the time of the freeze, but in southern districts cluster buds were showing on Fuerte. These proved very tender, and were usually killed wherever exposed. In many groves the freeze destroyed the crops of two years, killing the blossom buds as well as the mature fruit.

Putting out of new growth was prompt with Fuerte, but more or less delayed with Nabal and other Guatemalans. Trees completely defoliated, now show very little or no blossom on the new growth. Trees only partially defoliated show a variable scattering of bloom. Fuerte trees which dropped the mature fruit, but were not defoliated, later developed a normal bloom, the unusual lateness of which may prejudice the set of fruit

for next year. Trees which suffered no injury whatever have developed a late but heavy bloom.

EFFECTS ON THE SEED

For at least two months after the freeze, Fuerte seeds removed from moderately frozen fruits retained their normal appearance. It was generally assumed that they might be satisfactory for planting, and many were sold on a basis of guarantee of germination. However successful the germination of seeds from fruit which dropped on account of stem injury may have been, it developed that many seeds which appeared normal when planted, subsequently were found to have a black and dead spot at the base of the germ which rendered them worthless.

There is now an almost total lack of good Mexican type seeds for planting. The need for materially increasing the available nursery stock is indeed serious. I see no objection to using Fuerte seeds as a temporary expedient, provided that culling in the seed-bed is heavy enough to bring reasonable uniformity to a usually variable type.

EFFECTS ON THE CULTURAL PROGRAM

When avocado orchards have gone several years without cultivation, mats of feeding roots form near the surface and a sudden return to deep tillage is dangerous. Where trees have been completely defoliated and killed back to some extent, not all the fibrous feeders will be needed at first. Thus an opportunity is offered to return to cultivation where there may be good reason to do so, such as the need for suppressing Bermuda grass or other noxious weeds.

Not only the defoliated condition of the trees but the unusually heavy winter rainfall make it advisable to delay irrigation this year 'till long past the usual season. On account of the variable nature of most soils, variations in frost damage, and the top-working of trees, it will usually be advisable to begin irrigation by wetting the dry spots first, and follow with great care and constant use of the soil auger all during the season. As to fertilizer, the need for fertilization of trees entirely defoliated and not setting fruit this year, is greatly reduced or eliminated.

For the few avocado growers who are so situated that orchard heating is practicable, and where the frost hazard warrants, this subject is worthy of renewed interest.

EFFECTS ON THE VOGUE OF VARIETIES

Avocado trees in California have not been seriously affected by cold since 1922. During this fifteen year period most of the commercial development of avocados has taken place. Fifteen years ago our views on the variety problem were very different from what they are today. Commercial development during the last twelve years has taken place with the question as to relative hardiness of varieties more and more in the background. Now this question is brought very forcibly to the front. The subject will be covered this afternoon in the report of the Variety Committee. I may say here, however, that the

marked frost resistance of the Fuerte, coupled with its quick recovery where injured, has given this variety another boost toward complete dominance of the California industry. In locations where Fuerte bears with reasonable regularity, other good varieties, but of less cold resistance, are being increasingly top-worked to Fuerte. The effect of the freeze has been to change the trend toward growing Fuerte almost exclusively in Fuerte districts. More and more the production of summer varieties is being relegated to Ventura and Santa Barbara counties where Edranol, Ryan, and MacArthur are now holding attention. Along a narrow strip close to the sea on the South Coast, the top-working tendency is strongly toward Anaheim.

EFFECTS ON THE NURSERIES

During the depression the avocado nursery business was reduced to a very low volume. Last year saw some increase in production, but supply being still somewhat below demand, prices rose to around \$1.25. The freeze resulted in injury or loss of many trees in nurseries where heater protection was not adequate. This reduction in supply coupled with marked increase in demand has resulted in a raise in price to around \$2.00. Indications are for continued high prices in the spring of 1938, after which increase in available stock should bring lower prices.

EFFECTS ON DISEASES

The past winter was one of exceptionally heavy rains as well as of unusual cold. In my opinion, the effects of the freeze was beneficial when considered in connection with the two diseases, sunblotch and asphyxiation. I have no doubt that excess soil moisture would have brought about a marked increase in asphyxiation if the winter had been warm and the trees encouraged to continue in active growth. The dormancy caused by the cold as well as being defoliated during the later rains has prevented the peculiar condition which results in asphyxiation. So far I have not noticed a single case.

It seems to be true that occasional trees affected with sunblotch may send up very vigorous and apparently healthy shoots. Such shoots appear in some manner to get away to a healthy start, grow up through and overspread the older diseased branches, and for a time at least produce good fruit. While I am not in favor of long temporizing with sunblotch trees, it is reasonable to suppose that the effects of the freeze, in suddenly reducing the tops, may increase the incidence of such apparent recoveries.

Another effect of the freeze may very likely be an increase in the amount of dothiorella disease caused by the greatly increased amount of dead brush on which spores of the fungus are produced. In areas subject to dothiorella, it is important that all dead brush and frosted twigs be thoroughly cleaned out of Fuerte trees.

EFFECTS ON INSECT PESTS

So far as we know, the low temperatures experienced were not fatal to mature *Latania* scales or the eggs of the brown mite. There is some fear that the cold reduced the population of "twice-stabbed" ladybird beetles, the chief predator of *Latania* scale in San

Diego County. However, in many groves completely defoliated and killed back, the population of Latania scale was temporarily greatly reduced by death of host tissue. It is too early to foretell results of the freeze on insect pests, but it is doubtful if they will be of significance one way or the other.

EFFECTS ON THE MARKET

The Fuerte crop for 1937 was generally quite heavy and the quality and maturity were normal. Somewhere around 25 per cent of the crop had been harvested before the freeze. As soon as the freeze occurred picking was halted for a time and as much as possible of the picked fruit, then safely in storage, was shipped east in order to clear the Pacific Coast markets and prepare the way for the flood of slightly frosted but assuredly wholesome fruit which soon began dropping from the trees in large volume. The great bulk of this dropped and brown stemmed fruit which was picked was included in the February pool which amounted to 1,303,955 pounds at the Vista and Los Angeles packinghouses. This graded out roughly one-third each of Calavo grade, special pack, and culls. The grading of this frost damaged fruit presented a very serious problem.

At first consumers were suspicious of slightly frosted fruit, and this situation was not helped by a most unfortunate story given publicity in a local newspaper in which it was stated that frosted avocados might be poisonous. Calavo Growers promptly took the lead in giving out publicity correcting this absurd statement, and the general public was reassured. Soon the large displays and low prices encouraged consumers to function as they should under such circumstances and altogether almost a million pounds of Fuertes were eaten on the Pacific Coast during February. We now know that a fully mature Fuerte, which has been slightly frosted, while not necessarily showing any indication of frost on the exterior, may cut dark on the inside, have some dark spots around the fibres; yet soften satisfactorily, have a normal flavor, and aside from the poor appearance when soft, give good satisfaction as to eating quality. We have good reason to believe that the consumption of this large volume of fruit resulted in introducing the avocado to many new consumers who may have thus acquired a permanent liking for the fruit, and who, we feel sure, will help to increase future demand.

EFFECTS ON CALAVO AS AN ORGANIZATION

The size of the crop of avocados in California is subject to wider fluctuations than that of any other commercial fruit crop. This is true even under fairly normal conditions. Such a situation is a serious handicap to the cooperative marketing organization which, on that account, has difficulty keeping on an even keel. One year, with a large crop, the specially trained personnel is taxed to the limit, and the next year with a small crop, the same personnel and facilities may result in too great an overhead expense.

In order to overcome this difficulty, Calavo Growers, some years ago, organized the Calavo-Subtropic Fruit Company, all the stock of which is owned by Calavo. This subsidiary company operates as the distributing and sales agency of Calavo, and at the same time merchandises certain other fruits such as limes, dates, Florida avocados, etc. Subtropic, therefore, serves as a valuable balance wheel for the organization

providing adequate equipment and personnel to handle a large crop, yet by means of side-lines, earning maintenance and overhead in years of light avocado crops.

The effect of the freeze on the organization was to immediately necessitate a vast amount of extra and unexpected work, mostly crowded into the two months following the freeze. This having been done, attention was at once turned toward expanding the side-line business to take up the slack during the remainder of the season. The wisdom of this side-line business is thus fully demonstrated. Were it not for Subtropic, a major freeze such as occurred this year would have been fraught with most serious consequences to the organization. As it is, it may truthfully be said that even if all the avocados of the members had been lost in the 1937 freeze, Calavo could have carried on and maintained its personnel, its facilities, and its sound financial position without undue burden on the membership.

EFFECT ON THE AVOCADO INDUSTRY

The recent freeze was a check in the rapid increase in production which will allow a more orderly and economical development of markets. It was a very definite check to planting in cold locations. For several years past there has been no injury to avocados by cold to speak of, and some planters, particularly newcomers, were tending to forget or ignore the fact that avocado trees have very definite limitations in regard to frost resistance. There will be a comparatively small reduction in acreage by outright abandonment.

Many growers who entered the industry with inadequate capital during the period of inflated values, some eight or ten years ago, have had a hard struggle during the depression. For others, this freeze has meant the final liquidation of marginal groves.

In my opinion, shrinkage in acreage has run its course. The industry now faces a more normal and healthy growth. Let's go!

President Barrett: In building up this program on Effects of the Freeze, we cast about quite a bit looking for a man to present the general picture of the results, and the very comprehensive paper that you have just heard is justification for the confidence that we had in putting this job up to Dr. Coit.