Deciduous Fruit and Nut Crops

mild temperatures of 1950–51 winter cause concern to deciduous industry because of light crops in prospect

Dillon S. Brown

Deciduous fruit and nuts crops of northern California probably will be below normal in 1951.

It was too early in the first part of January to ascertain the extent of the fruit loss which may be expected, but it is improbable that there will be a complete crop failure, though some fruits in some districts may approach such a disastrous situation.

These pessimistic prospects are the result of the extreme mildness of the current fall and early winter season in northern California because mild winters mean light crops.

Insofar as it has been possible to check, there has never been a season in northern California which has been quite so mild.

Reasonably accurate records which are available from Davis, for the last 20 years are fairly indicative of the situation throughout the northern California deciduous fruit area. At least 300 hours below 45° F are normally experienced at Davis by December first. There were only 70 hours below 45° F by that date this season. December usually contributes an additional 400 hours for a total of 700 hours by January first. There were only 230 hours in Davis during December, most of which accumulated during the latter half of the month. This gives a total of 300 hours below 45° F for January first, which is about 43% of normal and actually 175 hours below the lowest January first total in the past 20 years.

Since October the weather has been very wet and cloudy with considerable fog in the Central Valleys. Such conditions tend to ameliorate a deficiency of temperatures below 45° F, but in mid-January it was too early to estimate the benefits the overcast skies for this season may have had.

It is possible that unless the January–February period contributes the normal amounts of chilling—425 hours in January and 260 hours in February below 45° F—the deciduous fruit prospects may well be rather grim.

Deciduous fruit trees react in two ways when winters are too mild to break the bud rest period completely. First, the trees may be slow to leaf out. A few of the buds producing leafy shoots may open at about the normal time, but the remaining shoot buds will straggle in opening into mid-summer. In fact, following the most extremely mild winters some shoot buds may remain dormant throughout the summer and not develop until exposed to a second winter's chilling.

The second reaction to mild winters concerns the flower or fruit buds. The bloom period instead of being completed within a relatively few days may be spread over several weeks. In addition, many flower buds may never open or if they do they may be nonfunctional. In some species, there may be sharp reductions in crop as a result of an actual abscission and dropping of the fruit buds before the bloom period.

The buds formed in fruit and nut trees in the summer of 1950 were the beginnings for 1951 shoots and leaves, and fruits or nuts. Normally the new formed buds on trees of the deciduous fruits will not grow to produce fruits and/or shoots during the same summer. Almost as soon as they are formed the new buds go into a state of rest—a condition in which they undergo no marked external evidence of growth even though environmental conditions may be favorable and other parts of the plant are still growing.

The resting buds are not entirely inactive, however. Initially all of the new buds appear under microscopic examination to contain only the embryonic elements of a leafy shoot, but during the resting period, the growing point inside of some of the buds differentiates from a leafy shoot into an embryonic flower, or in some fruits, into an embryonic flowering shoot. These differentiated buds contain the makings of the next season's fruits or nuts.

Despite such internal changes which are accompanied by only a slow and relatively inconspicuous increase in the overall size of the buds, neither the flower buds or the undifferentiated shoot buds are able to expand to form mature flowers or shoots as long as the rest influence inhibits such expansion. The exact nature of the rest influence is not understood, but it is recognized to be associated with the internal physiology of the bud and is probably under the control of the natural plant hormones.

Certain more or less shock treatments are known to end or break the rest period of buds. After exposure to ethylene gas, buds will grow when placed in a suitable environment. Temperatures above 110° F—but not high enough to kill the plants—will also break the rest. Under natural conditions the rest period of buds is broken by winter cold. In the main, temperatures below 45° F are effective—temperatures below freezing being no more effective than 37° F which perhaps, is the highest which is optimum.

During most winters the rest period of the buds of deciduous fruits and nuts is broken before the winter season is over. In that case, the buds still will not grow but only because temperatures during the remainder of the winter are too low for growth. However, once the rest is ended the buds can open and grow normally whenever favorable temperatures do prevail with the advent of spring.

The amount of winter cold required to break the rest period differs with the various species of fruit and nut trees. Almonds, for example, require very little chilling weather, two weeks exposure to temperatures below 45° F in early December usually being adequate. On the basis of their need for increasingly longer exposure to cold to break the rest, the other species might be arranged roughly as follows: apricot, Japanese plum, peach, prune, sweet cherry, pear, walnut, and apple.

Within a species there are also differences in chilling requirement between varieties. The Santa Barbara soft shell varieties of English walnut—as an example—require only about as much cold as does the apricot but the French varieties require nearly as much as the apple.

Some quantitative estimate of difference in chilling needs of the species is indicated by comparing apricots and pears. Apricots require between 700 and 1,000 hours below 45° F to break the rest, whereas pears probably need between 1,200 and 1,500 hours.

Apricots are especially prone to drop their flower buds after mild winters. Peaches as a group are less likely to drop their buds, but after the mildest winters some varieties, such as Mayflower and Libbee, may experience as severe a crop reduction from bud-drop as the apricots.

Continued on page 12

LEMONS

Continued from page 5

Potassium and phosphorus content of leaves decline with leaf age so lemon leaves showing spots are consistenlty low in phosphorus and potassium.

Since lemon trees showing leaf spots respond to phosphate fertilization and not to potassium fertilization, it appears that the composition of recently matured lemon leaves is a better indication of the nutrient status of the lemon tree than is the composition of the older leaves which show spots.

The symptoms found on the older leaves provide a field method for recognizing a nutrient deficiency in lemons which appears to be associated primarily with phosphorus.

Lemon leaves showing typical leaf spot symptoms are illustrated on page 5. The spots are brown to black in color—depending upon how recently they were formed—and generally are circular in shape but occasionally coalesce to form an elongated ovalar spot.

The spots occur on the upper side of the leaf usually between the main lateral veins. They are distributed somewhat along and inside the leaf margin and produce a slight depression in the leaf surface. The depression may be surrounded or partially infiltrated with a resinouslike material. Where the burn is severe on the oldest leaves the center may drop out but generally the burn is confined to the upper surface of the leaf. The lower side of the leaf shows some discoloration of the leaf surface directly below the depressed area of the spot.

In the initial stages of the burn the leaf area immediately surrounding the burn is chlorotic and forms a halo. As the leaf ages the chlorotic area surrounding the burn expands between the main lateral veins so that the oldest leaves appear also to have the chlorotic symptoms associated with iron and manganese deficiency.

Since the burn occurs on older leaves it is most prominent in affected lemon trees in the fall of the year, becoming most pronounced in October and November. By spring most of the burned leaves have fallen, new growth has started, and the leaf symptoms are hard to find.

More than normal defoliation during the winter is characteristic of phosphate deficient lemon trees. The defoliation may start in early fall and accounts for the broomlike habit of growth seen in many lemon groves now known to be deficient in phosphate. Only the most recent growth flush of leaves remains on the branches. Leaves which show no spots are usually lusterless, and gray-green to bronze in color.

The phosphate deficiency symptoms described here for lemons have never been found on orange trees despite the fact that orange groves are planted on some of the same properties where lemons show phosphate deficiency and are under the same management program.

Phosphate fertilizer trials on Valencia oranges were established simultaneously with lemon trials in one grove in San Diego County in spite of the lack of deficiency symptoms on the oranges. Field observations and leaf analysis data on this orange plot reveal that phosphate fertilization has had no apparent effect on growth or on leaf composition. Lemon trees on the same property have responded.

When it became apparent—during these trials—that soil applications of phosphate were producing pronounced vegetative stimulation, it became obvious that yield data should be obtained.

Recently several new and enlarged phosphate trials have been established in San Diego County on phosphate-deficient lemon groves for the express purpose of determining—over a long period of time—the influence of phosphate fertilization on lemon yields in such groves.

Fruit quality studies also have been started.

Part II of the above article, Substantial increase in yield of lemons followed application of phosphate in trials in two counties, *will be published in the March 1951 issue of California Agriculture.*

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DECIDUOUS

Continued from page 8

Although there is also a difference between varieties, plums and prunes usually suffer less from bud-drop than peaches. Apples and pears do not shed their flower buds, but the embryonic floral parts may dry up and become nonfunctional. Because of their high chilling requirement, a very prolonged period of bloom is the most serious effect of mild winters on flower buds of apples and pears.

Prolonged blooming periods enhance the problems of using the pest control measures usually applied during bloom, as for example, the problem of blossom control of fire blight in pears is made extremely difficult. Furthermore, prolonged bloom may upset provisions for cross-pollination in those species for which it is required. Scattered bloom and marked variations in the time of bloom of pollinating varieties may result in very light sets of fruit.

Problems of frost protection in the early blooming species, such as almonds, will be increased when the bloom period is protracted.

Another indication of the gravity of the current situation is the fact that there has been some at least mild bud-drop on some almond varieties. Because of their low chilling requirement bud-drop is practically unheard of in almonds. There probably will not be a serious loss this season in almonds from the bud-drop itself, since good chilling weather in late December probably checked this tendency on most varieties. However, there is a considerable variation between buds in their stage of development so that a long blooming period may pertain, a situation which might be unfavorable to set from the standpoint of cross-pollination and from an increased frost haazrd.

Bud-drop will probably be moderate to heavy in apricots, and a very light crop may result. Normally, unless at least 400 hours of chilling are received by January first, apricot bud-drop is heavy. In the second week of January no appreciable bud-drop had started on apricots, but microscopic examination of the buds revealed some signs of abnormality which indicate that a high proportion of the buds may shed.

The degree of loss to expect in peaches will depend largely on the chilling received in January and February. Microscopic examination of peach buds from some orchards around Davis indicate that a very heavy drop may occur, at least from trees relatively low in vigor and of those varieties most prone to shed their buds. It seems safe to predict that at least the peach crop will be considerably lighter than normal and that in most sections there will be a less than normal need for fruit thinning during the summer.

The probable situation with other fruits is not yet clear. Some bud-drop is likely on the most susceptible varieties of prunes and plums. However, those varieties producing a heavy set of buds should suffer proportionately less from loss of buds, although prolonged bloom and possibly poor pollinating conditions may reduce the crop. Cherries also will probably suffer from a period of extended bloom with a resultant relatively poor set of fruit. The pear picture will be determined largely by the adequacy of January and February chilling, though some reduction in crop may be expected.

The amount of chilling in January and February in northern California will probably determine the canned fruit picture because of the dominant part this area plays in the canned fruit supply. If the weather in these months is nearly normal, the reduction in the crop of peaches and pears may not be too great. If temperatures much milder than normal pre-

Continued on page 14

TOMATOES

Continued from preceding page

the second hybrid—red crossed with tangerine—only the *Tt* pair segregates, while all plants have both *RR* genes. Thus, the *T* gene is dominant over the *t* gene. In the case of the third hybrid—yellow crossed with tangerine—both of the gene pairs segregate.

From a study of the three hybrids and their progeny, it is clear that at least one *R* and one *T* is necessary for the formation of the red carotenoid pigment, lycopene. The precise role of these two gene pairs in the formation of carotenoid pigments is not entirely clear. There are two uncertainties that will require further study. First, the double recessive *rrtt* has not yet been identified. Second, certain yellow tomatoes collected in Mexico are definitely anomalous. When collected, they were classified as doubtful yellows. When grown in Berkeley, they did not behave as pure yellow varieties, but were consistently intermediate between red and yellow.

Independent studies carried on at Riverside suggest that three gene pairs determining pigment differences segregating in the species cross—*Lycopersicon esculentum* crossed with *L. peruvianum*—one of the green-fruited wild species. This fact together with the two uncertainties mentioned indicate that only a beginning has been made in the study of inheritance of tomato pigment differences.

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ORCHIDS

Continued from page 7

In full-grown plants the symptoms are similar to those on seedlings. Infections start on any part of a leaf but the most dangerous location is at the base because then the infection quickly moves into the growing point and the plant is doomed.

Phalaenopsis plants of all ages are equally susceptible to the disease.

In Cattleya brown spot is often confined to the upper part of the leaf. The progress of the disease is not as rapid as in Phalaenopsis. The lesion has well-defined margins and the color is nearer black than brown. The disease very seldom causes death in Cattleyas.

Control of brown spot is achieved by the use of one part 8-quinolinol benzoate to 2,000 parts of water or the sodium salt of o-hydroxidiphenyl—Natriphene—also at the rate of 1:2,000. In Cattleyas brown spot may be treated locally by swabbing it with a solution of corrosive sublimate, 1:1,000. If necessary, the treatments may be repeated within a week or so.

Soft Rot

Soft rot of Cattleya orchids caused by *Erwinia carotovora* is a rare disease. Its advent is sudden and the results are devastating. It is caused by the common soft rot bacterium—a soil inhabitant—which attacks such crops as celery, carrots, and potatoes.

The disease can start in fresh wounds on Cattleya leaves and with high temperature and very high humidity it will rapidly change the leaf into a sack containing liquefied tissues. The leaf wrinkles and droops. Later it breaks open and the contents leak out.

Plants affected by it can not be saved. Control consists in early recognition of the disease and burning all the affected plants. The room in which the trouble occurred should be promptly and thoroughly disinfected.

Brown Rot

Cypripediums are the only orchids in California subject to the brown rot disease in orchid houses. It is caused by a bacterium, *Erwinia cypripedii,* which prefers a temperature of 65° F or above and a humidity of 70% or higher.

The disease is characterized by small to medium-sized circular, somewhat greasy spots which, on running together, form large sunken patches. The color varies with the age of the lesion and in the final stages is deep chestnut brown. The spots are frequently located close to the base of a leaf. Under favorable conditions the organisms migrate into the crown and thence into other buds causing death of all the living components of the clump. To save plants already attacked the treatment described above for brown spot of Phalaenopsis should be applied.

Bacterial Scorch

Bacterial scorch and pseudobulb rot has been observed recently on Miltonia orchid hybrids. It is most severe under conditions favorable for Miltonia growing—cool and moist greenhouses.

The disease starts in wounds which are always present on the brittle leaves of Miltonia. The bacteria are exuded copiously on the surface of the leaf and may be spread by the water in syringing operations from one pot to another, thus creating an epidemic.

The affected leaves are water soaked in early stages of the disease but later turn gray and even light brown and appear scorched or blighted. Sometimes the disease is in the form of a narrow or wide streak, terminating in the growing point on the pseudobulb which turns at first a delicate yellow changing into orange red or red. The leaves finally drop off and numerous orange red pseudobulbs can be seen in the pot. From the pseudobulb the organism migrates into the rhizome and will travel from plant to plant.

The disease is very infectious and requires immediate attention as soon as it is first recognized. The control consists in applying 8-quinolinol or Natriphene as for brown spot in Phalaenopsis. Sanitary measures must be observed and operators should disinfect their hands after handling infected Miltonias so as not to spread the disease.

Black Spot

The shippers of orchid blossoms also have troubles. Vanda blossoms shipped from a distance sometimes develop a black spot right in the throat of the blossom. Sometimes minute black spots scattered on the petals of the flower ruin its market value. The trouble is due to *Glomerella* sp., a fungus similar in its habits to the gray mold fungus *Botrytis cinerea* which sometimes attacks the flowers of Cattleya in greenhouses and in transit.

Black spot infection of Vanda flowers occurs before they are cut and shipped. When it reaches its destination the flower begins to lose its color and black spots appear. The fungus develops slowly at the low temperature prevailing in shipment but in the higher temperature of the sales room the fungus grows and produces the black spot. Black spot infection of Vanda blossoms has been prevented by the use of 8-quinolinol benzoate 1:2,000 as a spray. This concentration of the chemical did not injure the appearance of the flowers.

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DECIDUOUS

Continued from page 12

vail, a serious shortage could result. Such a shortage would undoubtedly give an upward boost to the price structure on canned fruits all the way from the grower to the consumer.

With January and February temperature playing a critical role in the final outcome, it will be mid-March or early April before accurate estimates of the situation can be made. By then the blossom periods for most species will have been reached or past and a real estimate of the fruit actually set can be made.

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