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PESTS AND DISEASES OF THE AVOCADO

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Mr. Chairman, Ladies and Gentlemen;

From the time avocados were first grown in California to the present, the tree has been subject to comparatively few pests or diseases, and so far growers have not found it necessary to spray or fumigate. While this is very fortunate, we should not fall into the error of assuming that this happy condition will continue forever. While we may save ourselves much loss by rigidly excluding pests and diseases which may be introduced from other avocado growing regions, it is entirely possible that as the industry develops, organisms which are native here, on wild plants perhaps, may find the avocado a congenial host, and transfer their activities to it. It behooves us therefore to be forever watchful, and investigate, and report anything which appears to be suspicious.

You may think before I finish that I have presented a formidable list of pests and diseases, but I wish to allay your fears at the outset by stating that at present in California none of the pests described are causing very serious damage, but they will all bear watching.

Deer, Rabbits, and smaller Animals

Wild deer are particularly fond of the tender new growth of the avocado. Where plantings are made near protected areas or game preserves, the deer are likely to come down from the mountains in late summer and fall when wild green food is scarce, and browse on the new growth of young trees so that the trees become stunted and sunburned and are ruined. Trees once well started and over three years old are seldom injured, but in many places along the foothills it is difficult to get young trees started on account of the depredations of deer. The only remedy for legally protected deer is to fence the plantings against them.

When plantings are made near large areas of wild brush land, cottontail rabbits are likely to gnaw the bark from the newly planted trees. This may be prevented by either fencing or by extending the wrappings, which are used to prevent sunburn, up on the main trunk to a point above which the rabbits cannot reach.

On account of the high fat content, most small animals are very fond of avocados. Skunks, coyotes, and dogs prefer to eat fruit which has fallen to the ground and has softened, although the writer once observed two bull-terriers in the act of pulling Fuerte avocados from the trees and burying them like bones for future use.

Grey squirrels, opossums, and field mice, all climb the trees and eat the fruit while it is still firm. Where there are many grey squirrels in an adjoining wood-lot they may do a

great amount of damage by cutting small holes in a great number of fruits.

Insect Pests

Several kinds of scale insects, such as black scale and red scale, have been observed on avocados, but none are yet serious. The most common scale to be observed is the Greedy scale which is so prevalent on Camphor trees. Many of the large Mexican Seedling avocados used for street trees are heavily infested with Greedy Scale, yet the trees are thrifty and seem not to suffer material harm. In Florida the Dyciospermum scale is said to be so serious on avocados as to require spraying. This scale has been introduced into Los Angeles on ornamental palms and every effort is being made to eradicate the infestation before it spreads to the avocado orchards.

When avocados are interplanted in citrus orchards which are infested with Citrophylus mealy-bugs, the mealy-bugs may be seen on the avocado trees, but in my experience I have not observed them to breed on the avocado trees or infest them injuriously. They seem to be there more or less by accident. I once top-budded some large seedling avocados in a mealy-bug infested orange grove. The mealy-bugs found the space between the bud and the waxed tape wrapping an ideal place to hide and would crowd in there till the space was packed full of bugs. In some cases I thought the bud was injured, but in other cases the buds grew. At any rate the mealy-bugs furnished me with a good alibi for the buds which did not grow.

Various leaf eating caterpillars and grasshoppers have occasionally been noted in somewhat injurious numbers. Once I observed avocado trees heavily infested with the common garden snail, but they disappeared when warm dry weather came. A species of night flying May beetle proved very injurious to newly planted avocado trees in northern San Diego County in 1924 and 1925 and some plantings were sprayed with arsenate of lead. As soon as the trees gained some size the damage was insignificant. Occasionally some orange grower plants an avocado tree in a vacant space among large orange trees which are heavily infested with Fuller's Rose Beetle. These will at once attack the young avocado and perhaps kill it unless protected by a band of cotton wool placed around the trunk.

A very small leaf miner frequently leaves the tracings of its burrows on the young growing stems of avocado nursery stock, and in some cases injures the appearance of the trees. The work of the same insect may very occasionally be seen on the avocado fruit. The Broad Nosed Grain weevil attacks Mexican avocado seeds after they have lain on the ground under the tree for some time. The seeds may be completely riddled and ruined by the burrows. The simple remedy is to pick up the seeds as fast as they fall, and throw out all weevil infested seed before placing the good ones in storage.

There is a species of thrips which attacks foliage and fruit of some varieties of Mexican avocados in a very limited area along the coast near • San Diego. Affected fruit is rusty and of poor appearance. This pest will "bear watching and it may become sufficiently damaging to warrant spraying with lime-sulphur.

Diseases

There are certain physiological or nutritional diseases which should be considered separately from pathogenic diseases which are caused by some form of parasite.

Tip-Burn: In some localities this is a really serious trouble which manifests itself by a dying back of the tips of the leaves. It is most serious on sandy soils close to the coast and particularly in situations fully exposed to the salt ocean breeze. Although it has been investigated for some years, its nature is not understood. There are as many theories to account for it as there are growers. Trees may suffer and recover from several attacks within a year. The most commonly accepted theory is that it is connected with faulty soil moisture which in turn may be occasioned by defects in the physical makeup of the soil. Sandy surface soil overlying heavy clay subsoil close to the coast and exposed to the ocean wind are the conditions most favorable to serious tip-burn. An exception to this is an area near Montebello, where a number of groves are badly tip-burned though some distance back from the sea. We are badly in need of a thorough going scientific investigation of this trouble.

Fizzles: Leaves much reduced in size and pale in color accompanied by multiple buds and broom-like growths. More common in interior sections and on light gravel soils where drainage is excessive. Trees may almost die and then recover. Pruning back has no effect as new growths are as frizzled as ever. Nothing definite is known as to the nature of this disease. My experience is that large quantities of manure left as a mulch on the surface with very frequent light watering may sometimes bring marked improvement

Apoplexy. The very sudden death of a few of the finest and most healthy trees in the grove. Both leaves and fruit dry up and remain firmly attached to the dead tree. Examination of root system shows everything normal. Fortunately this trouble is rare and usually occurs on very heavy soil types soon after heavy late spring rains which are followed by warm weather. Nothing definite appears to be known as to the cause of this trouble, and it is possible that it may be pathogenic in nature.

Chlorosis. Foliage of trees turn white or pale yellow with stunted growth, and poor development. Nearly always limited to certain spots, areas, or streaks in otherwise good orchards. Probably due to peculiar chemical constituents of the soil. Should be investigated by chemists and if possible a method found for determining in advance where chlorosis is likely to occur.

Sun-Blotch

I am hard put to it for a suitable name for this trouble which I am convinced is really a disease. In my opinion the trouble starts with weak, spindling or poorly cared for nursery trees. Frequently when weak spindling trees begin to sunburn on the main stem and branches, the tree fails to produce an upright top, the branches assuming a drooping form, like a weeping mulberry tree. The old bark becomes very rough and scaly. The new growth usually shows yellow streaks in the bark and when fruit is produced it is often badly distorted by depressed yellow or reddish yellow blotches so that it is worthless. Once initiated by sunburn, this condition appears to be hereditary and in my opinion may be communicated both through the seed and the buds. No way is known of curing an affected tree. It is highly important not to use budwood from a tree which shows the slightest tendency to blotch on either twigs or fruit. I have observed this trouble in typical form on Fuerte, Puebla, Linda, Dickinson, Mayapan and some seedlings. This is indeed a serious trouble, but it has been my observation that it can be

completely avoided by using strong, stocky nursery trees well cut back at planting, and given such good care as to force them quickly into vigorous upright growth.

Anthracnose: This is a fungus disease caused by *colletotrichum gleosporioides*, It is particularly troublesome on the Fuerte. Dark spots appear on the fruit while still on the tree, which are not easily detected at first. Later, in storage or in transit, the spots enlarge and a kind of decay penetrates to the seed. It is difficult to grade against it and some fruit arrives on the market in a decayed condition. It is possible that the fungus also works on weak or dead twigs and branches on the shaded interior of the trees. Possibly these should be kept cleaned out. We are badly in need of some research work on this trouble. As the trees increase in age, it may become necessary to spray with a fungicide.

Ring-neck An affection of Fuertes which appears to be due to some organism. The outer bark of the stem of the fruits dies, turns brown, and scales off, leaving the inner part, or core of the stem alive. When affected in the early or medium stages of growth, the fruits cease to grow and remain stunted and small. The trouble is common and in some districts considerable damage is done. So far, though slightly investigated, nothing has been published as the cause or control of this disease. It is barely possible that it may be another type of injury by the anthracnose fungus.

Blast: There is a russetting, or scabbing of the surface of mature fruits of some varieties, particularly Taft. It occurs principally along the interior foothills and is often quite serious, resulting in cracking and dropping of much fruit. It has been found by investigators that this is caused by a bacterium, the same which causes citrus blast on oranges and black pit on lemon fruits. The organism occurs naturally on a certain species of native live oak and in rainy and windy weather is spread to the citrus and avocado plantings which may be near these oak trees. So far blast has not occurred near the coast, and there the Taft variety remains smooth and green until late in the fall. On account of this trouble, Taft and other susceptible varieties should not be planted along interior foothills. So far the Fuerte appears to be immune. Spraying might control it but no experiments have been carried out.

Black-Crack: This trouble appears to be limited to the Fuerte along interior foothills. The fruit while still on the trees cracks open with a very firm and black colored decay, so in many cases the seed is partly exposed. As all such fruits are discarded in the orchard, there has been no complaint from the packing-house. Nothing is known as to the nature of this disease and fortunately it is rather rare.

End-Spots: Many varieties have a tendency to spot and crack at the blossom end when fully mature. Such varieties are Blakeman, Ganter, Harmon, Ward and many Mexican Seedlings. In my opinion this is due to lack of uniformity in maturing. The blossom end of the fruit matures some weeks before the stem end. If the fruit is left on the trees till the stem end is mature, the blossom end is deteriorated from being over ripe. If the fruit is picked before the spot appears on the blossom end, the stem end is likely to shrivel and be of poor quality. As this is a varietal characteristic, the remedy is to avoid such varieties as show it.

Oak Root Fungus: Here we have a well known parasitic fungus of world wide distribution which works on the roots of many kinds of trees and causes heavy losses in

plantings of walnuts, citrus and most other fruits. The fruiting bodies appear in rainy weather as clusters of brown toad-stools clustered against the trunks of affected trees. The fungus rots away the root system and by girdling the crown kills many trees. On account of its working underground, there is no very satisfactory commercial control. Practically all kinds of fruit trees are susceptible except the pear. It was at first thought that the avocado was immune because there were no cases on record of its being attacked. However I have seen two cases, both of which were examined by Dr. Fawcett and pronounced to be genuine oak root fungus. It appears likely that the avocado is more resistant than other trees, but we now know that it is not entirely immune.