# Dry Bark of Lemons Prevalent

## in coastal areas on various rootstocks and found to extend inland

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**Dry bark kills** or renders worthless a great many lemon trees every year.

The disease is particularly bad in plantings within 10 miles of the ocean but it has been observed farther inland, and effects both Eureka and Lisbon varieties.

The type of rootstock used is apparently of little importance in influencing the onset and severity of the disease, for badly diseased trees have been found on the following rootstocks: Grapefruit, rough lemon, sweet lemon, sour orange, sweet orange, and Sampson tangelo.

Eureka trees with dry bark are mostly six to 15 years old. Lisbons with the disease are 14 to 22 years old.

### Recognition

Dry bark kills the outer and middle layers of bark on the trunk and lower branches. Usually only a paper thin layer of inner bark remains alive.

The inner bark generally is much darker than normal and, in time, may become hard and brittle. Between the bark and the wood the cambium turns yellow and becomes somewhat drier than in a healthy tree. As a result, little or no new wood or bark is produced.

In extremely severe cases, the inner bark dies and eventually, if the girdling is completed, the tree dies.

Dry bark closely resembles shell bark in several respects, but differs in that the bark is killed nearer the wood.

Frequently the dead outer bark does not shell at all, but cracks vertically and becomes finely cross-checked.

The dead bark adheres tightly to the trunk because the tissues in which the shelling mechanism generally forms are destroyed or seriously damaged. In some cases the bark begins to shell, then stops when the underlying bark is killed.

In very early stages of dry bark, thin, vertical, platelike areas of discolored tissue appear in the middle bark. These pink to light reddish brown spots enlarge rapidly during late winter and spring. As they enlarge, the bark over them deteriorates, dies and rots.

Various fungi are involved in decaying the dead bark. The extension of diseased bark and the accompanying deterioration of the tree is so rapid that a tree may appear perfectly healthy one year and absolutely worthless the next.

The first lesions commonly appear near the bud union, just below the crotch, or near the forks of the larger branches. Numerous lesions may start at about the same time and spread until they merge. Small lesions frequently appear in the branches far above the main outbreak.

### Not Easily Detected

Dry bark is not easily detected by casual observation. Close inspection generally is necessary to see the checking, and minute scratches may be made on suspected trees to determine whether the bark is dead. Gum frequently oozes from lesions, but is by no means characteristic of the disease.

Lesions seldom extend below the bud union, but occasionally, as a result of fungus infection, may cross in a "U" onto a very limited portion of the rootstock. Those lesions which cross the union are soon delimited and corked off.

Top symptoms accompanying dry bark are yellowing of leaves and partial to nearly complete defoliation, lack of new growth and a reduction of bloom and fruit set. Trees with dry bark soon develop a generally ragged appearance.

No definite root symptoms have been observed to be associated with the early stages of dry bark. The roots of badly diseased trees, being severely starved by the girdling effect of branch and tree lesions, may be considerably damaged within a year or two after top symptoms appear.

Injury progresses from the small roots toward the tree. The bark of dead roots rots and may slough away.

### Cause

Susceptibility to dry bark, or possibly the disease itself, is obviously transmitted through the scion bud.

Possible causes of the disease appear to be hereditary weakness, clonal senescence, or virus infection. Fungi—important in the disease complex—are thought to be secondary factors.

Inoculations with the fungi commonly found in dry-bark lesions—*Phomopsis citri, Botrytis cinerea, Dothiorella gregaria, Diplodia* sp.—have failed to produce drybark lesions, even on diseased trees.

Dry bark appears to be an extremely severe form of shell bark and is probably due to the same causes.

High relative humidity is believed to favor the development of dry bark, since many affected trees are found within a few miles of the ocean and few are present in the intermediate valleys. There is a high incidence of dry bark lesions during moist weather, and dry bark lesions tend to stop growing soon after the onset of hot, dry weather.

### No Natural Spread

There is no indication of any natural spread of dry bark. Trees with a natural resistance to this disease have remained healthy in close proximity to dry bark trees.

Experiments are now in progress to determine whether dry bark can be transmitted to healthy trees by budding or grafting. Thus far, no evidence of transmission has been obtained.

### Experimental Treatments

Various chemicals and paints have been tried for the retardation and control

Continued on page 15

**Trunk of 8-year-old Eureka lemon with *dry bark*. Note fine checking and failure to shell.**

# Red Scale On Citrus

## use of DDT for control studied

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**DDT-kerosene sprays** for control of red scale on citrus are not recommended beyond very limited field trials because of disadvantages and hazards associated with their use.

The most effective use of DDT has resulted when the compound is dissolved in kerosene with the aid of a mutual solvent. The residual DDT deposit apparently prevents scale crawlers from settling on the sprayed surfaces, or prevents them from developing.

DDT is not strictly stable, particularly when exposed to direct sunlight and certain other conditions of weathering, and adult scale not affected by the initial spray continue to produce crawlers for a period exceeding that during which the DDT residue remains toxic to crawlers. A second spray application is necessary approximately six weeks after the first spray to replenish the DDT deposit. The second application can be somewhat less complete than the first spray, generally requiring from two thirds to three fourths as much gallonage with particular emphasis on very complete outside coverage.

The degree of control obtained from DDT-kerosene spray schedules is not apparent shortly after treatment. A significant proportion of the scale population on the trees at the time of the initial spray, particularly the older stages, will remain on the various parts of the tree, ostensibly until they die of natural causes. A year or longer after treatment, counts made on the outer fruit, leaves, and green wood usually show less than 10% of the scale population that was present on these units of the trees prior to treatment.

### Advantages

The use of a DDT-kerosene spray program eliminates some of the disadvantages associated with the use of conventional oil sprays. Postapplication fruit drop and leaf drop which have often characterized the oil-sprayed plots have not usually been a factor in the comparable DDT-kerosene-sprayed plots. Additionally, DDT-kerosene-sprayed fruits have been consistently higher in total soluble solids than oil-sprayed fruits.

DDT-kerosene spray schedules have given satisfactory results when started as early in the year as February and as late as November.

If the application is properly timed, the use of DDT-kerosene in the manner suggested as necessary for red scale control also will control such citrus pests as yellow scale, purple scale, black scale, citricola scale, citrus thrips and others. Good control of the citrus bud mite on lemons will be provided by applications made in the early spring or fall.

As yet there is no evidence that DDT residues on citrus fruit following this treatment will exceed established tolerances or that personnel making spray applications will be endangered if ordinary safety precautions are observed. Individual cases of hypersensitivity to either DDT or kerosene may be encountered and may necessitate shifting of affected individuals to other work.

### Disadvantages

At the present time the minimum cost of materials for the DDT-kerosene two-spray schedule is more than twice the cost of materials for a single oil spray. Added to this is the labor cost for the second application. Hence materials and application will cost approximately two times as much as the cost of a single oil spray. The cost is further increased by the need for separate control of the citrus red mite—red spider—which consistently builds up to damaging levels in DDT-kerosene-treated groves.

On the basis of the necessarily limited observations made thus far, it is not possible to predict the extent to which cottony cushion scale or other economic pests might become serious problems if extensive use is made of DDT-kerosene for red scale control.

### Tree Injury

Instances of acute tree injury have been encountered during the course of the experimental studies. The extent of the injury has not been prohibitive in most cases and the following of certain precautions will minimize the chances of tree injury. Established cases of chronic injury have been limited to the girdling of several small trees just below the surface of the soil. It is expected that other cases will be observed with certain combinations of circumstances which as yet are not fully understood.

In general, groves in the interior areas have been less susceptible to injury from DDT-kerosene sprays than groves in the coastal areas.

In closely planted groves the extra movement of equipment through the grove necessitated by the second spray and the subsequent red spider treatments may be objectionable. In similar groves or contour-planted groves in which it is impractical to dust or spray-dust, additional expense will be encountered in making spray applications for red spider.

Strict adherence to established procedures will minimize the danger of achieving inadequate red scale control or encountering damaging tree effects.

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## LEMONS

Continued from page 13

of dry bark but in general the preliminary results are discouraging.

Scarification is also being used on an experimental basis.

Although certain trees have shown some response to severe pruning others have not. The recommended practice is to remove dry-bark trees as soon as they become unprofitable.

### Budwood

The time to prevent dry bark is the time at which budwood is selected. Nothing can be done to control the disease if trees are grown from buds from parents susceptible to dry bark.

The practice of selecting buds from young trees of unknown parentage is an open invitation to trouble.

The occurrence of forms of bark disease intermediate between ordinary shell bark and dry bark, and the fact that some of the worst dry-bark trees near the coast were budded in inland nurseries—apparently from parents which never developed dry bark although they did develop shell bark—suggests the advisability of selecting local parent trees which are free from both shell bark and dry bark for a period of more than 20 years for the Eureka variety and 30 years for the Lisbon.

Certain lemon strain selections being grown experimentally show considerable promise of resistance to dry bark and shell bark. New clones have not yet been adequately tested, but may possibly be resistant.

It is suggested that, until various strains and new clones have been thoroughly tested, new lemon plantings in regions where dry bark is a problem should be made only from buds taken from trees or strains which have shown satisfactory dry bark resistance.

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