# 2,4-D Damage to Young Citrus

## young lemon, orange, and grapefruit trees may be severely damaged by direct application of, or by the drift of 2,4-D

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**About 5,000 young** citrus trees—less than six years old—in the major citrus areas of California have been ruined or killed by 2,4-D within the past 10 years. Most of the injured trees were lemons, but extensive damage to young orange and grapefruit trees has been observed. Severe damage has been found on only a few trees more than six years old.

Because the proper use of 2,4-D in mature citrus orchards has shown remarkable effects in increasing fruit size and in decreasing losses from fruit and leaf drop, fruit stem dieback, water spot, splits with the resulting black rot—caused by *Alternaria citri*—and in controlling weeds, some of the cases of severe injury to young trees may be due to gross errors in application. Other cases of injury may be attributable to unusual situations—or new formulations—not previously encountered in the use of 2,4-D on citrus.

In November 1953, a four-year-old Valencia orange orchard in San Diego County was examined—at the request of the grower—in an effort to diagnose the cause of a severe outbreak of suspected gummosis. Most of the 1,000 trees of a 10-acre area were affected. Although 2,4-D had been used in the orchard for weed control, no plant growth regulator had been applied to the trees. The trunk injuries resembled brown rot gummosis, but the lesions were not typical because the dead bark was soft and cheesy in texture and tan in color. Many of the trees were dead and most of the others were so badly injured they required removal. Many attempts at isolation of a causal organism failed to reveal the presence of Phytophthora brown rot fungi. No leaf symptoms typical of the 2,4-D damage were seen. However, the destruction from bark lesions typical of 2,4-D on the 10 acres of young orange trees—and later, on 10 acres of young lemons set out during the spring prior to the application of a 2,4-D herbicide—indicated that the plant growth regulator was responsible for the damage.

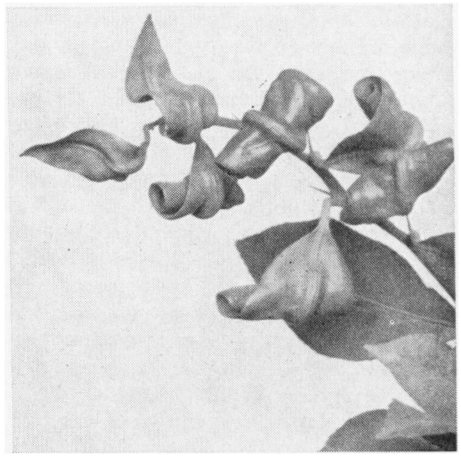
The young lemon trees showed typical leaf symptoms of 2,4-D injury in addition to bark lesions at the ground level. Much of the damage to these trees, grown in sandy soil and irrigated by sprinklers, may have been caused by the absorption of 2,4-D through the roots.

For further investigation, young Valencia oranges on sweet orange rootstock were potted in soil obtained from the affected ranch. The soil was treated experimentally with herbicide containing 2,500 ppm—parts per million—of 2,4-D.

Small roots of trees in containers with 1.06 ounces or more of this herbicide emulsion per square foot were damaged. This amount of herbicide is equivalent to 7.2 pounds per acre of actual 2,4-D. Large roots and trunks of trees in containers with 4.24 ounces or more of herbicide per square foot—28.8 pounds per acre—of actual 2,4-D were severely damaged.

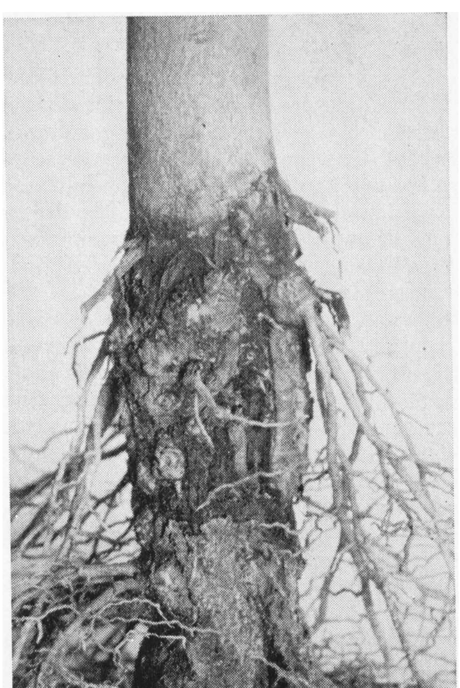
These results show that mere avoidance of direct contact of 2,4-D with above-ground parts of a citrus tree does not guarantee safety from injury.

Recently, serious damage and death of young citrus trees in an orchard in San Bernardino County and in another orchard near Riverside resulted from spraying with a low concentration of low-volatile 2,4-D—reportedly 4 ppm—in oil emulsion. The spray was applied as an insecticide with 2,4-D added to lessen defoliation. Both leaf and trunk bark symptoms were in evidence in the Riverside orchard. In addition, in some cases where the stems were covered by protectors, the bark was injured as much as 18″ to 24″ above the ground level. Because of the proximity of the application to the period of hot weather in August and September 1955, it is possible that injury from the chemical may have been accentuated by the heat.



Distortion of immature leaves of 1½-year-old Prior Lisbon lemon which received a foliage application of supposedly four ppm 2,4-D in insecticidal spray. The trunk of this tree was practically girdled below the soil line.

Extreme damage to rootstock bark and roots of a 1½-year-old sweet orange stock—with Valencia orange top—from experimental soil treatment with an herbicide containing 2,500 ppm 2,4-D. Soil was treated at rate of 4.24 ounces per square foot.



Severe damage from 2,4-D in two Ventura County citrus orchards also emphasizes the need for keeping 2,4-D away from young trees. In one orchard, two-year-old Valencia orange interplants in an older Valencia block were ruined by a reported 16 ppm of 2,4-D in a nutritional spray applied by boom in July. Bark damage seemed confined to Rough lemon rootstock below the soil line.

In the other Ventura County orchard—where young Eureka lemon on Rough lemon alternate with young Prior Lisbon on sweet orange—the Rough lemon rootstocks were girdled, but the sweet orange rootstocks did not appear damaged by an insecticidal oil spray from a spray rig previously used for applying 2,4-D fruit-sizing sprays on oranges. Damage occurred mostly in trees sprayed from the first tankful.

The examples above illustrate the haz-

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ard of using 2,4-D on or near young citrus trees. In contrast, there have been numerous instances in 1955 where young interset or replant trees were sprayed, without resulting trunk damage, just before or just after the hottest weather with concentrations of 2,4-D recommended for older trees. However, it may be wise to assume that heavy applications of the material applied for weed control cause some damage to the root system of any citrus tree. The type of formulation and amount of the chemical applied, texture of the soil, and method of irrigation are important considerations. Certainly large applications on light soil under sprinkler irrigation should be avoided.

To avoid injury or death of young citrus trees from 2,4-D—and until conditions are defined and measures developed for the completely safe use of 2,4-D in citrus orchards—carelessness in application and the use of contaminated spray equipment should be avoided.

Foliage sprays for citrus trees less than six years old and for those recently topworked should not contain 2,4-D. Replants and young interplants in older orchards are frequently very sensitive to 2,4-D. Also, there is good evidence that Rough lemon and Cleopatra mandarin rootstocks are especially sensitive to 2,4-D.

If 2,4-D is inadvertently applied to vigorous young citrus trees, it is then advisable to avoid further wetting of the trunks or the soil near the trunks by additional sprinkling or other irrigation. Withholding irrigation as long as practicable may help to reduce the damage.

Injury from 2,4-D to rootstock bark opens the way for fungus invasion of the bark and wood. Lesions on the rootstock may heal better if they are exposed to the air and treated with a noninjurious fungicidal paint such as Captan 50-W in water.

Spray tanks, pumps, hoses, booms, buckets—all equipment—once used with 2,4-D must be thoroughly cleansed before using them to spray foliage of young trees. It is so difficult to remove 2,4-D residues from tanks and sprayers that—when possible — separate equipment should be maintained.

As an herbicide, 2,4-D should not be used in the nursery and it should be kept away from the root zone of young citrus trees, especially in sprinkler-irrigated orchards. Until more specific information is developed, 2,4-D herbicides should not be applied closer than two feet to the tree trunks and should be used sparingly on the soil above the root zones of young trees. Applications close to the rainy season may increase the hazard.

Herbicides containing 2,4-D should be kept off citrus trunks and branches, young or old. Bark of young trees is especially sensitive. Both accidental drift and direct applications are very dangerous.

Whenever 2,4-D is used in tree sprays, the amount and formulation used must be correct for the particular situation.

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## WALNUTS

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and leaves move back to the current season's—and adjacent—twig growth.

Most of the scale crawlers on the leaf petioles and twig growth are killed when either of the systemic aphicides—Systox or OMPA—is incorporated in the May DDT codling moth spray. However, where Systox is applied most of the scales on the leaves survive, but where OMPA is used there is a high mortality. To gain further information on the fate of the crawlers that settle on the leaves, three surveys of the experimental treatments at Linden were conducted during the summer of 1955. On all surveys, five leaflets were picked at random about the skirt of each of five trees so that a total of 25 leaflets were examined per plot or at least 50 per treatment. The average number found per impression of ½" diameter along with the information on the treatments is given in the table on page 11.

The number of scales present in the OMPA treatments declined as the dosage increased. The largest number was found where 0.7 pound of total actives was applied per acre and the lowest where the two-pound dosage was used. The difference between 1½ pounds and two pounds treatments was not great and in both cases only a few scales were found.

Where Systox was applied, there was a large population of live scales after all the treatments. Further, there was some indication that the population increased as the amount of Systox was increased. The evidence certainly appears to show that Systox is not effective against the scale crawlers that settle on the leaves.

The findings in regards to OMPA and Systox are substantiated by a survey conducted in the experimental plots at Modesto.

OMPA is more likely to reduce the frosted scale population than is Systox. On March 23, 1955, twig samples three inches in length were examined from plots treated with OMPA or Systox in 1954. The scale population was much lower and the per cent of scales parasitized was generally higher in the OMPA treated plots than in the Systox plots.

In June, surveys were conducted to further determine the per cent of the old scales that had been parasitized. The per cent of scales parasitized in the OMPA treatments was much higher than in the Systox plots. At the time the surveys were made it took considerable searching to find scales in the OMPA plots while they were abundant in Systox treatments.

The results obtained where nonsystemic aphicides were applied show that a pound treatment of parathion wettable powder exerted a marked controlling influence upon the scale. The beneficial action resulted from the July 1 application—probably—because the scales were in the developing egg stage, protected by the body of the parent at the time of the May application.

Malathion 25% wettable powder at three pounds per acre exerted a suppressing action on the scale, but it was somewhat less than that resulting from one pound of parathion 25% wettable powder.

The nicotine treatment demonstrated no beneficial action.

The July 1 treatment of one pound parathion 25% wettable powder was also applied to plots where conventional sprayers were used to apply the May codling moth spray. One series of these plots had received five pounds of DDT 50% wettable powder, and the other 7½ pounds DDT 50% wettable powder per acre. In both series the parathion treatment reduced the scale population to a low level. The smallest population occurred in the plots that received the lowest dosage of DDT in the codling moth spray. The frosted scale can be controlled at any time of the year except for the period of rapid growth—mid-March to mid-June—until the eggs have hatched. During this time it is next to impossible to control the pest with insecticides. Also, this is the period when quantities of honeydew are produced.

The best and most economical time to control the scale is during the summer and fall after the eggs have hatched. During this period satisfactory control can be obtained where two pounds of parathion 25% wettable powder are applied per acre in 200 gallons of water with an air carrier sprayer. Malathion 25% wettable powder at a rate of six pounds per acre can be substituted for parathion in areas where the latter may be too hazardous to apply.

Parathion can also be used to control the scale during the cold part of the year.