Fruit Drop of Lemons

2,4-D and 2,4,5-T water sprays reduce mature fruit drop, with little effect on drop of immature fruit

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Field-plot measurements of the effect of 2,4-D and related compounds on fruit drop, fruit production, and leaf drop of Eureka lemon trees were made on eight experimental field plots.

Two of the plots were established in Santa Barbara County in the fall of 1946; two in Ventura County and one in Riverside County in the spring of 1947; and two in Riverside County and one in Ventura County in the spring of 1948.

Applications of growth regulators were made as drenching water sprays, using standard spray equipment. Measurements of leaf drop and of immature fruit drop were made in some plots where mature fruit drop did not occur. These counts were made by placing boxes or nets under the trees to catch the dropped leaves and young fruit. Within any one plot the counts were comparable. Counts of mature fruit drop were made by removing the fruit on the ground under the trees at the time of spraying and making subsequent periodic counts of fallen fruit. Fruit production was measured by determining field-box yield at harvest time. Partially filled boxes were estimated to the nearest tenth of a box.

Effectiveness

Results obtained show that both 2,4-D—2,4-dichlorophenoxyacetic acid—and 2,-4,5-T—2,4,5-tricholorphenoxyacetic acid—sprays at concentrations as low as five parts per million—ppm—were effective in reducing drop of mature lemons, but that 2,4,5-T was more effective than 2,4-D. This difference in effectiveness has also been noted in storage tests, where the fruit from trees sprayed with 2,4,5-T maintained more green buttons than fruit from trees sprayed with 2,4-D even though the 2,4-D sprayed fruit had more green buttons than fruit from nonsprayed trees. In other tests, in which the fruit was not sprayed on the tree but was treated at the packing house just before storage, 2,4,5-T was considerably more effective than 2,4-D in maintaining green buttons.

Leaf-drop observations also demonstrated the effectiveness of 2,4-D and 2,4,5-T in reducing leaf drop. As with fruit drop, 2,4,5-T was more effective than 2,4-D.

In none of the plots was a significant difference in drop of immature lemon fruit observed as a result of the sprays. This agrees with findings that the drop of young, immature orange fruit—June drop—was not permanently reduced by 2,4-D or 2,4,5-T. A significant increase in the drop of young lemon fruit might be anticipated at higher concentrations of these chemicals, since this was found to be the case with immature orange fruit.

Curling of Leaves

Water-spray solutions containing as little as five ppm 2,4-D or 2,4,5-T, when used on young, rapidly growing shoots of lemon trees, generally resulted in curling and deformation of the young leaf blades. When concentrations of 20 ppm, or less, of 2,4-D or 2,4,5-T were applied, subsequent growth flushes were normal. The amount of leaf curl resulting from a 20 ppm spray applied once a year has not been found to reduce fruit quality or yield; this may be attributed to the presence of the succeeding four or more cycles of nondistorted leaf growth per year. Curling of young leaves was reduced or eliminated when the sprays were applied between growth flushes, or when there was a minimum of new growth. Since it is not always practicable to spray at this time, it would be desirable to reduce or eliminate the leaf-curling effect of the sprays. Preliminary trials indicated that the leaf-curling response to 2,4-D could be eliminated by including activated carbon in the spray. Spray preparations containing sufficient activated carbon to eliminate leaf curling, however, were found to have no significant effect in reducing fruit drop, probably because the activated carbon adsorbed and held the 2,4-D or 2,4,5-T. When insufficient activated carbon was added to eliminate leaf curling, the sprays—at the concentrations tested—seemed to be as effective in increasing fruit production as when no activated carbon was added.

Fruit Production

In the two field plots where fruit-production records were obtained, the greatest yield increases were observed as a result of the 2,4,5-T application. With 2,4-D as the triethanolamine salt the yield also increased significantly, although the 2,4-D as the isopropyl ester failed to do so.

In the first plot the spray was applied on April 1, 1948, and the yield increases were observed in the first two harvests, which occurred within 3½ months after spraying. This increase was accounted for on the basis of a reduction in fruit drop from the sprayed trees.

The second plot was sprayed on April 8, 1948. Yield records were obtained from 10 harvests over more than a year's time. An increase of 31.9% in field boxes of fruit was found as a result of spraying trees with eight ppm 2,4,5-T. The yield from trees sprayed with eight ppm 2,4-D as the triethanolamine salt was increased 24.4%. These increases resulted mainly from the fifth harvest on November 26, 1948—about 7½ months after application. At this time there was a yield increase of 109.7% as a result of the eight ppm 2,4,5-T spray. The spray containing the triethanolamine salt of 2,4-D increased yield at this harvest 56.5%. The 2,4-D isopropyl ester spray failed to increase yield significantly.

Fruit Size

The yield increases in this plot were not the result of fruit-drop reduction, since there was very little fruit drop, but were apparently due to an increased fruit size. This was indicated at the fifth harvest by counts of the fruit per field box, as well as by casual observation. An increase in fruit size has also been observed as a result of the use of 2,4-D and 2,4,5-T sprays on orange and grapefruit trees.

The results from the second plot also indicated that on lemons the triethanolamine salt of 2,4-D is more effective than the isopropyl ester of 2,4-D in increasing fruit size and yield. There were indications in other plots that this same relationship between the triethanolamine salt of 2,4-D and the isopropyl ester likewise applied to fruit drop. The increased effectiveness of the triethanolamine salt of 2,4-D may be due to the fact that it is less volatile than the ester and, accordingly, persists on the plant for a longer time. Thus, the amine salt would be expected to exert its influence on plant growth during a longer time and to be more effective than the ester. Since 2,4,5-T, in the ester form, was more effective than the amine salt of 2,4-D in increasing yield, it is in-

Continued on page 14

DROP

Continued from page 6

teresting to speculate on even how much more effective 2,4,5-T in the amine form might be.

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DWARFING

Continued from page 5

are very sensitive to cold and at Riverside have shown more damage from cold than any of the other combinations. Fruit produced on this stock is very low in acid and has a tendency to be somewhat insipid. The stock itself is very susceptible to gummosis. It is questionable if this stock has sufficient merit to warrant its usage in California.

The Cuban Shaddock produces substandard sized trees. Marsh grapefruit trees on this stock after 14 years of age are 70% as large as trees 17 years old on sweet root. They produced as much fruit in the first 10 years as the trees on sweet root, but in the last six years have yielded only 71% as much. Washington Navel orange trees on this stock at 14 years of age are 45% as large as 17-year-old trees on sweet root. Production for the first 10 years is about the same as on sweet root, but in the last six years has dropped to 80% of the check trees. Eureka lemons on this stock in 1947 were 48% as large as trees on sweet root which were three years older. They produced 66% as much fruit for the first 10-year period as trees on sweet root. Unfortunately, there were no trees on sweet root of the same age for comparison, but obviously the difference in size and production of the two combinations cannot be entirely accounted for by the three years difference in their ages. Trees on this stock tend to have a heavy early production, but this is not maintained in later years. This rootstock appears to be fairly susceptible to footrot. In general, its effect on the top is to produce poorer fruit quality and a tendency toward greater damage from low temperatures than when conventional rootstocks are used.

Eureka lemon cuttings budded to Valencia oranges were also part of the orange rootstock trials. After 18 years these trees approximate 8½ feet in height as compared to comparable trees on sweet root which are 16 feet in height. They have produced 60% as much fruit in the first 10 years, but only 42% as much in the last six. Fruit quality is below average and the combination is easily damaged by low temperatures. In addition to being susceptible to gummosis this rootstock is susceptible to shellbark. It may also be another source of psorosis if the parent lemon trees were carrying the disease. As a rootstock it has little to recommend it other than the dwarfing tendency.

Most citrus growers in California prefer those combinations which produce large or standard sized orchard trees. While in general tree size and fruitfulness are associated, they are not always correlated. Long-lived, healthy, and productive dwarfed combinations may have a definite place in plantings made by the home grower and perhaps the orchardist.

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OLIVE

Continued from page 3

ceding the 1949 crop only and bore 124 pounds per tree as compared with 28 pounds for the check trees. All the 1949 girdling in this orchard was done on February 15.

There was a reduction in fruit size of the heavier crop on the girdled trees, but this was offset easily by the greatly increased yields.

Using the yield records and size grades, and computing on an acre basis from the 15 girdled trees in this test orchard the increase in gross return in 1949 over non-girdled trees would amount to approximately $620 per acre at 50 trees per acre.

Girdling of olive trees is not recommended at present for use as a genreal practice but it may be worthwhile to try—in an experimental manner—on a limited number of trees in orchards which have a habit of blooming heavily but failing to set good crops.

Under such conditions the following suggestions are made:

1. The primary scaffold branches should be girdled about the middle of February, with one or two branches on each tree left ungirdled to supply the roots with carbohydrates until the girdling cuts heal over.

2. Girdling cuts are made most easily with a grape-girdling knife in areas with smooth bark. The soft bark should be removed down to the hard inner wood in a strip, not to exceed one fourth inch in width, completely around the branch.

3. The cuts should be covered immediately with either hot grafting wax or with an asphalt emulsion grafting compound. In orchards infected with Olive Knot provision should be made to prevent infection starting in the cuts. Also the girdling knives should be dipped after each cut in a disinfectant to prevent spread of the disease.

4. To determine accurately whether the girdling has been beneficial it is desirable to obtain yield records during harvest from the girdled trees and from adjacent trees of comparable size.

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INJECTIONS

Continued from page 10

tity of dilute acid soluble phosphorus and potassium in this soil is very low and correlates well with the low phosphorus and potassium content of the leaves.

Lemon orchards with the leaf spotting referred to here have been noted in parts of Santa Barbara, Ventura, Tulare, and San Diego counties. More recent analyses show that the leaves obtained from these same areas are also very low in phosphorus.

Apropos of leaf analysis as a diagnostic tool, it can be stated that so far, responses to tree injection of phosphorus and potassium have been obtained only where exceedingly low levels of these elements were found in the leaves. Previous tree injection work using mono-calcium phosphate and di-potassium phosphate in Ventura, Orange, and Riverside counties failed to produce response in trees having phosphorus and potassium levels considered adequate by current standards.

This is the first time in California that citrus trees in the field—with leaves of a known low phosphorus and potassium content—have responded to phosphate and potassium treatment.

This response of citrus to phosphorus in southern California is of interest in the light of previous failures of many field trials with citrus to show responses from these elements.

It remains for future work to determine whether the response of lemons to phosphorus and potassium injections reported in this article can be duplicated by soil treatments.

It seems certain, based on the extensive leaf analysis surveys and soil studies of phosphate and potash in citrus groves made previously, that many groves are amply supplied with these constituents.

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