Mechanical Pruning for Citrus

hedging and topping machines effective in increasing yields and reducing pruning costs during four years of field tests

Paul W. Moore

Annual pruning of mature, thrifty lemons with hedging and topping machines—supplemented by some hand pruning—is a means of cutting pruning cost by 30% to 50% without sacrificing either yield or fruit quality.

Lemons can be hedged or topped or both one or two times annually but oranges, grapefruit and mandarins usually are hedged or topped at intervals of several years.

Part of a mature lemon orchard in Ventura County was pruned by machine only twice each year for a period of three years. The trees were topped by machine six times and side hedged on two sides six times. At the end of the three-year period the machine pruned plot was hand pruned to remove accumulated dead brush, thin out the tops, and reduce height.

Average production per year for mechanically pruned trees was 589 field boxes per acre compared to only 488 boxes from the hand-pruned trees. No differences in fruit quality were detected between the two treatments.

Average annual pruning costs—including brush disposal and the corrective hand pruning—for the machine-pruned trees was $45 per acre compared to $86 for the hand-pruned trees.

The average annual value of the fruit—at $1.25 per box—was $126 per acre greater on the machine-pruned plot than the hand-pruned trees. The savings in pruning costs resulting from the use of machines was $41 per acre per year.

A second test, also in Ventura County, compared production from trees which were hand pruned only with trees machine hedged on one side in alternate middles; and with others hedged on two sides. The total yield from the three comparisons for the three-year period was 1,534 field boxes per acre from the hand-pruned trees; 1,664 boxes from those hedged on one side and 1,860 boxes from trees hedged on two sides.

A third experiment—on Eureka Lemons in the Pauma Valley of San Diego County—showed similar trends in yield. Here a comparison was made between trees which had received no pruning since they were planted, trees hedged on one side, and trees hedged on two sides. One year after the first hedging, half of the trees were hedged across the rows to give additional comparisons for trees hedged on three and four sides.

Hedging was done in May following what was essentially a clean-up-pick. A good bloom was still on the trees and fruit set was not complete. The trees were crowded. Interlacing of branches from adjoining trees was common.

It was apparent in this experiment that—with proper timing—even severe hedging did not reduce production and over the three-year period, hedged trees produced better than unpruned trees.

The average annual production per

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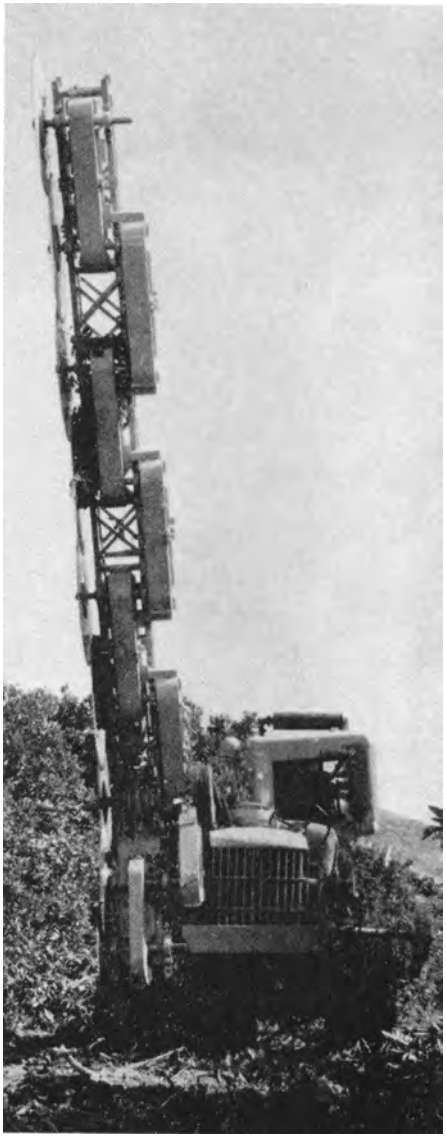
Front view of heavy duty hedging machine built for custom work.



A trailer mounted hedging machine using twelve 14" diameter saws driven by a 25 H.P. air-cooled engine. This machine is capable of hedging lemons, oranges or grapefruit on two sides of each row at the rate of ¾ to 1 acre per hour.

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acre for the three-year period—September 1, 1955 to August 31, 1958—was: no pruning, 1,109 boxes; hedged, one side, 1,176 boxes; hedged, two sides, 1,137 boxes.

In the third experiment, two other advantages resulted from hedging. Spray gallonage for pest control purposes was reduced about 20% and the more open condition of the orchard facilitated picking and the lighting of orchard heaters.

Box Rows in Oranges

Light hedging—to maintain width of box rows—before crowding becomes a problem has resulted in no loss of crop.

Moderate hedging—which cuts off a side slab not exceeding 12″–15″ in depth—has resulted in losses in the following crop amounting to 0.2–0.4 box per tree.

Severe hedging—which cuts into the tree as much as 2′–4′—has reduced the first crop by about one box per tree.

In a Navel orchard near Hemet, average yields per tree for the first crop following hedging were: no hedging, 8.2 boxes; hedged lightly one side, 8.8 boxes; and hedged severely—as much as 3′—one side, 7.3 boxes. However, in the next three crops, the severely hedged trees produced slightly more fruit than the unhedged trees. The four-year average annual production for trees from these three comparisons was 5.65 boxes for the unhedged trees; 5.70 for the lightly hedged; and 5.55 for those severely hedged in the box row.

In a Valencia orchard in Tulare County, where trees in box rows were hedged back 1′–2′, yield was reduced 0.4 box in the first year. However, by the third crop, the trees averaged 1.3 boxes more than the unhedged trees.

To correct overcrowding in a Valencia orchard in eastern Los Angeles County alternate middles in one part of the orchard and every middle in another part were hedged. Average yield per tree was 7.4 boxes in both plots.

In a Navel orchard in Riverside County, trees hedged by alternate rows averaged 7.5 boxes and trees pruned by hedging in every middle averaged 7.9 boxes.

Trees in an orchard of Navels in Tulare County hedged in the same two patterns produced an average of 4.4 boxes per tree whether hedged on one side only or on two sides.

An extreme type of machine pruning is to hedge on four sides of a tree. As with the other patterns of hedging, loss of first crop is usually in direct proportion to the severity of cutting. However, in a few cases, trees hedged on four sides have borne as much fruit in the crop following hedging as did the unpruned trees. One such case occurred in a Valen-

***Left*—Heavy duty hedging machine showin s**

Two types of topping machines. *Below*—Inexpe cutting unit. Canvas drape collects prunings and bar can be adjusted from 7′ to 14′ above groun topped annually. *Right*—Heavy duty topper for ous fruits. The orange trees have been hedged have had 4′–5′ cut from tops. Tre

cia orchard in eastern Los Angeles County. In this test the hedging was done in a year when a very low production was general for the area. Average yields by treatments the first year were: unpruned, 1.6 boxes per tree; hedged one side, 1.8 boxes; hedged two sides, 2.0 boxes; hedged three sides, 1.9 boxes; and hedged four sides, 2.2 boxes.

An extreme case of overcrowding was relieved by hedging four sides of trees in a Navel orchard in Tulare County. The trees were cut back approximately three feet on each side. Comparing the first crop, the heavily cut trees yielded 5.1 boxes per tree and the unhedged trees 5.3 boxes. For the second crop, the trees hedged severely yielded 5.3 boxes per tree as compared to 3.9 boxes for their checks.

A third experiment—in a Valencia orchard in the Lindsay district—trees hedged on four sides were compared to unhedged trees. An attempt was made to semi-skeletonize relatively thin, sparsely foliated, medium sized trees by cutting back at least three feet on four sides. This severe treatment resulted in the loss of crop for the first season. For the three crops which followed, production of the semi-skeletonized trees was equal to that of check trees in the second crop, two boxes per tree greater in the third crop and equal in the fourth. The severely hedged trees are now more thrifty than the unhedged trees and, although they are about one-half the volume of the unpruned trees, they are bearing equal crops and have larger sized fruit.

Effects on Fruit Sizes

When fruit set on new growth on hedged sides of trees were compared for size with fruit set on less vigorous unhedged sides of the same tree, there were from 10% to 17% more fruit in the larger sizes—old carton size 100 or larger—on the hedged sides. In the case of the semi-skeletonized orchard in the Lindsay district, there was 23% more large sized fruit on the machine pruned trees, in a year when the average crop in the two treatments—hedged and unhedged—was equal.

Timing

The timing of the hedging operation—whether for lemons or the other citrus varieties—is usually determined by the practical consideration of its effect on the crop on the tree. Hedging is usually done following fruit harvest, or in the case of lemons, southern California Valencias and grapefruit, when the trees are carrying the least amount of fruit.

Tree recovery has been satisfactory following hedging during the months of February to mid August. No observations have been made of trees hedged during

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aws entering tree for a 2' cut from the side.

nsive lemon topping machine using a sickle-bar drops them between trees. Height of cutting d. Lemon trees in background are hedged and use on lemons, oranges, grapefruit and deciduon two sides. The trees on the left of the topper e on right has not been topped.

Induced Increase of Soft Scale

imbalance between scales and natural enemies on walnut trees in northern California results in scale population increases

A. E. Michelbacher and Stephen Hitchcock

The principal natural enemies of soft scales attacking walnut trees in northern California are small winged parasites easily killed by trace amounts of insecticides. If undisturbed, the parasites are able to maintain the scale population much below an economic level.

Three species of soft scale—the frosted scale, the European fruit lecanium, and the calico scale—occur on walnut in northern California. All three species have but a single generation a year. The eggs hatch in May and June and the young settle on both the lower and upper surfaces of the new leaves. Although capable of movement they stay pretty much in one place. In the fall most individuals move back to the twig growth before the leaves drop. They cast their skins and remain principally on the undersides of the twigs throughout the winter as elongated, oval, brown individuals that measure about 1/16″ in length. In March they cast their skins again after which growth becomes rapid. Eggs are produced in April and early May after which the scale mother dies. The eggs hatch and another generation is started. Development is one to several weeks more rapid in the case of calico scale and the European fruit lecanium than it is with the frosted scale.

Heavy infestations of soft scales seriously injure the trees. Vigor and size of leaf are greatly reduced which are reflected in a lowering of the quantity and quality of the nut crop.

Under most conditions it is difficult to determine accurately the real damage caused by a single sucking pest because of the presence of others. With walnuts the situation is usually complicated by the presence of the walnut aphid, spider mites, or armored scales.

Two methods were used in determining scale populations in experimental plots. During the dormant season and until the eggs hatched, the number of alive individuals on selected samples—of the basal 2″ of the past season's twig growth on the lower branches of the trees—were counted. In cases where effective control measures had been applied, the count area was increased to 10″ and the number of individuals present per 2″ was calculated. Further, post treatment surveys were not made until spring—after the scales had begun to make rapid growth—so the few survivors could be seen more easily. On each survey, 25 twigs per plot were examined, and in some cases the number was increased to 50.

Average Number of Live Scales per Leaf Sample in Plots Treated with Different Aphicides in the Experimental Orchard at Linden*

Insecticide	No. of years applied to plots	Av. no. live scales per sample	
		Frosted & European fruit Lacanium complex	Calico
OMPA	1	1.04	0.04
OMPA	2	1.13	0.10
OMPA	3	0.14	0.17
Parathion	3	0.02	0.01
Malathion	3	0.10	0.03
BHC-demeton .	2	1.00	0.06

* Leaf samples 15 millimeters in diameter.

After the eggs hatched and until the leaves dropped from the trees, the scale population was determined by counting the number of individuals found on sections of the next-to-terminal leaflets. Three sections, each 15 mm—millimeters—in diameter, along the mid rib of a leaflet were counted for scales on both the upper and lower surfaces. At least 75 sample areas were examined in each plot on every survey.

In the experimental areas, the plots were practically free of all pests with the exception of soft scales. An application of schradan—OMPA—had freed the plots of the walnut aphid for the entire growing season. Such plots, where heavily infested—20–40 individuals per leaf sample—looked unproductive when compared to surrounding plots where both scales and aphids were controlled.

The parasites of the soft scales are adversely affected by insecticides. DDT and similar materials used to control codling moth or the walnut aphid have a definite adverse effect on the parasites, especially when the parasites are in the adult stage.

The systemic insecticides, demeton—Systox—and schradan—OMPA—have been associated with the increase in the scale problem, although they appear to exert a strong suppressing action on the scale population. The suppressing action of OMPA is more marked than that of demeton. Highly destructive scale populations developed in experimental plots in every case where demeton was used—in combination with the codling moth spray—to control the walnut aphid.

Except in the case of the calico scale, OMPA tends to hold the soft scale population in control. The beneficial action becomes more marked with increased dosage. However, there is little suppressing action when OMPA is applied to foliage that has hardened or where large scale populations are already present. The peculiar action of OMPA tends to increase the calico scale population with the number of years that OMPA is applied. Plots treated with schradan can be distinguished from the other treatments by a higher incidence of the calico scale.

Why systemic insecticides should result in an increase of soft scales is not known. Some physiological or physical action might be involved or the chemicals may in one way or another interfere with parasitism. It is possible that scales surviving specific treatments suck up sufficient amounts of the systemic materials to become toxic to many of the developing parasites.

A. E. Michelbacher is Professor of Entomology, University of California, Berkeley.

Stephen Hitchcock is Research Assistant in Entomology, University of California, Berkeley.

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fall and winter months when little or no new growth is made. A late growth flush could be damaged by frost.

Machine topping of oranges and grapefruit has lagged behind the topping of lemons because the lemon topping machines used sickle-bar mowers—for cutting units—which are much too light to cut the larger limbs of oranges and grapefruit. However, topping machines are available now that use saws from 14″ to 32″ in diameter as cutting units. Saws 24″ in diameter—or larger—can cut limbs as large as 6″ in diameter.

The winter and spring of 1957–58 was the first year that extensive machine topping trials were made with large orange and grapefruit trees and it is too early to evaluate the treatment.

Paul W. Moore is Specialist in Horticulture, University of California, Riverside, California.

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