

# Citrus Grove Rejuvenation Study

ten areas selected for stationwide research on problems of decline in production and fruit size

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**A comprehensive research program** designed to determine and correct the less obvious causes of the decline in production and decrease in fruit size—for the entire citrus industry—is under way.

The work schedule of the research program was laid out to include a sufficient number of districts to allow a sound evaluation of treatments for the whole industry. A survey was made to determine trends in production, rootstocks, missing trees, obvious reasons for declining production—scaly bark, and so forth—and to map the grove. Four or five groves most suitable for experimental work are selected from this survey and are then inspected by a committee representing stationwide participation. The members of the committee submit reports on the grove—or groves—they believe most desirable for studies. They also list the treatments for which their department will be responsible. These reports are assembled and a coordinated experimental plan is developed by the entire committee. It is expected that as soon as any one treatment shows promise, it will be further tested on an intensive basis in many locations beside the



Appearance of a Valencia orange tree immediately after skeletonizing.

areas where these initial, exploratory tests are made. The districts considered for these first trials are: Claremont—navel oranges; Redlands—navel oranges; Highland—navel oranges; Olive—Valencia oranges; Placentia—Valen-

cia oranges; Santa Paula—Valencia oranges; Ventura—lemons; Strathmore—navel oranges; Corona—lemons; Riverside—navel oranges.

## Treatments

A predominating characteristic in groves thus far selected for treatment is apparently a scarcity of feeder roots, especially in the irrigated middles. On this basis, treatments expected to favor root growth have been installed. These treatments consist of changing from furrow to sprinkler irrigation, fumigating the soil in which the trees are growing, and use of a wood-shavings mulch. The treatments are applied both singly and in various combinations.

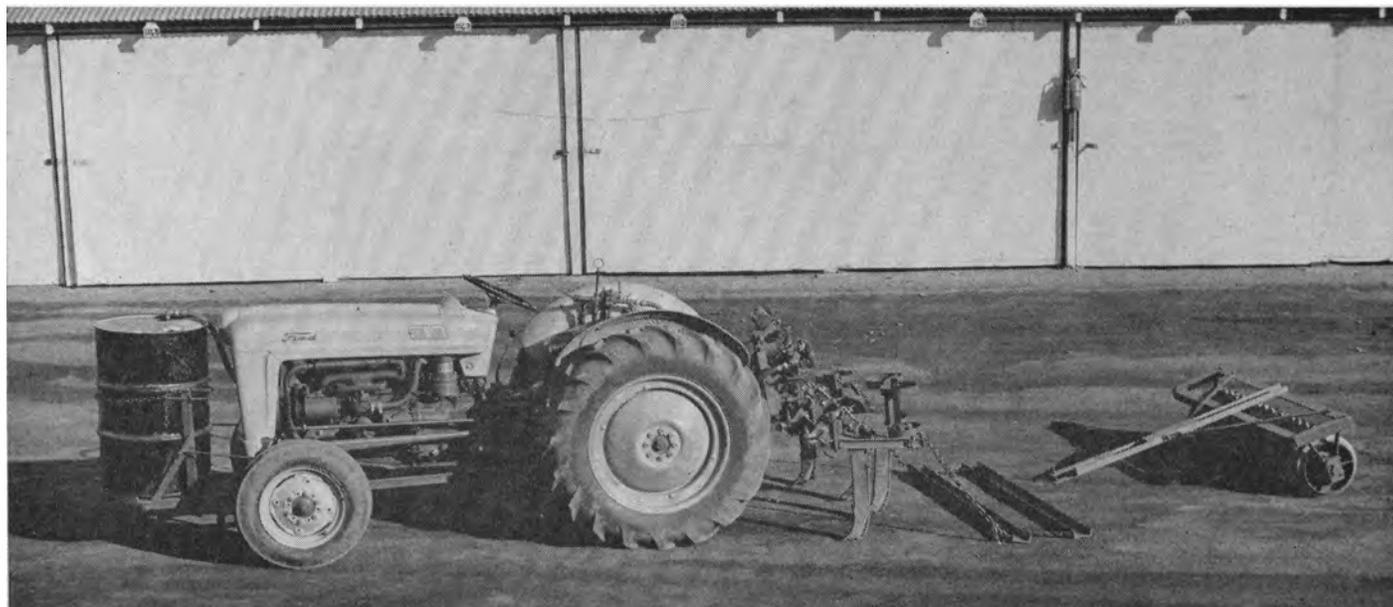
The treatments installed in the groves now under study are:

1. Soil fumigated, with D-D injected in every other middle at the rate of 70 gallons per acre; wood-shavings mulch; sprinkler irrigation.

2. Soil fumigated as in treatment No. 1; no mulch; furrow irrigation.

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**Fumigation machine used for tests. This machine can expel fumigant by either a gear pump or by compressed gas. The cultipacker follows after injection and helps to seal the soil.**



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3. Soil not fumigated; no mulch; sprinkler irrigation.

4. Soil not fumigated; wood-shavings mulch; sprinkler irrigation.

5. Soil fumigated as in treatments No. 1 and No. 2; no mulch; sprinkler irrigation.

6. Grower's present practice—furrow irrigation; no mulch; no soil fumigation—as a basis for comparison with the experimental treatments.

In the fumigation treatment, alternate middle fumigation is used to avoid tree damage; the middles not initially treated will be fumigated a year later.

In addition, half of all the trees receiving the above treatments have oil-spray pest control, while the other half have pest control by the use of non-oil insecticides such as parathion.

For convenience, the six treatments are called a package deal. It is anticipated that the package-deal treatments will be installed in each of the ten localities. This should furnish an adequate basis for the evaluation of their effectiveness for further widespread testing.

In each of the above groves, the nutritional status of the trees is being evaluated by both leaf and soil analyses. Fertilizer applications will be made to correct any unfavorable conditions.

While the package-deal treatments are expected to be the first offensive, considerable attention is being given to pruning practices. Pruning treatments, involving sidewalling or hedging, top



Close-up showing detail of injection chisel.

thinning, and skeletonizing, are being installed to the extent manpower allows.

Other field treatments include testing of promising new soil fumigants applied around existing trees, inarching old trees with nematode resistant rootstock—Troyer citrange and trifoliolate orange—and fumigation with varying amounts of D-D.

### Preliminary Results

The first package deal was installed in May, 1953, in a navel orange grove in the Claremont district. By July, it appeared that the trees receiving sprinkler

irrigation were producing more new leaf growth and had a larger fruit size than those receiving furrow irrigation.

Fruit-size measurements made during the fall confirmed this observation. Along with the size increase, development of the orange rind color was delayed about two weeks.

Thus far no effect of fumigation or mulch has been observed. In view of fruit-size increases of lemons which resulted from soil fumigation, a delay in response of 2-4 years is anticipated.

Observations in a sprinkler irrigated wood-shavings mulch lemon orchard near Claremont have led to the finding—for the first time in a southern California citrus grove—of two different kinds of fungi which are natural enemies of nematodes. Also, in this soil and apparently favored by the mulch, is another fungus, *Trichoderma* sp., which is an enemy of citrus root-rotting fungi—such as *Phytophthora* sp., *Rhizoctonia* sp. These factors indicate the need for further investigations on the influence of various types of mulches.

The navel rejuvenation test groves in Redlands and in Highland were installed in October and November, 1953, and in June, 1954, the groves had shown no differences in response to the treatments. The treatment installations in the Olive and Placentia groves were completed in December, 1953, and likewise had shown no responses in June, 1954. However, results of the experiments are beginning to accumulate.

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Side view of citrus grove hedging machine developed for experimental use.

