Citrus Orchard Cost Study And Analysis Made In Orange County Over 21-Year Period Is Reported

(Continued from page 1)

about $30.00 per acre. If manures were applied to supply some of this nitrogen the cost went up to almost $50.00 per acre.

From data the growers supplied it appears that the grower who spent more than $50.00 to $60.00 per acre on his fertilizer budget last year could not justify the extra cost.

Nitrogen and organic matter, with an application of zinc spray for zinc deficiency, have been recommended by the Agricultural Extension Service as an efficient fertilizer program. Organic matter may be added in the form of cover crops or manures. If the orchard is under the non-tillage system of soil management, additional organic matter may not be so necessary because the soil is not stirred and the organic matter is not consumed or oxidized so rapidly.

Conservative Irrigation

In the first years of this study, the average use of water was 21 acre inches per acre. In recent years the average use has been 17 to 18 acre inches per acre.

Many orchards in Orange County have declined in vigor and production because of excessive use of water.

In sandy soils too much water has leached down the soluble plant food elements to below the root zone. In heavier soils, too frequent or too early irrigation created a soggy environment around the roots and gradually reduced their vigor by the exclusion of essential soil air.

the reports show 75c to $1.00 an hour for general work and $1.00 to $1.25 an hour for tractor men.

The average cost per acre for pruning labor in the five year period, 1926-30, was $10.47 per acre for Valencias. In 1945, for the same operation, the average cost was $31.14 per acre.

In the late 20's the average harvesting cost was 16c per packed box. Last year it was 37c per packed box.

In 1930—a small crop year—yields averaged 142 packed boxes per acre. The grower received $4.99 a packed box. Sixteen years later — 1946 — in another small crop year, the average yield was 166 packed boxes per acre. The grower received $3.40 a packed box in 1946.

Economic Factors

Important economic factors influenced those prices and returns.

In 1930, the total shipments of Valencias amounted to 10,300,000 boxes from 96,200 acres of orchard. The rate of consumption was 12.5 oranges per capita.

In 1946, total shipments were reported at 27,100,000 boxes from 148,700 acres of orchard. The per capita consumption was 36.1 Valencias, or three times the 1930 figure.

The total amount of oranges, of all varieties and sources, consumed fresh was 46.2 oranges per capita in 1930 and 98.8 oranges per capita in 1946.

Last year, 37.4 oranges per capita were diverted to juices and by-products.

Use of Irrigation Water Per Acre

Prepared from water-use reports for the period 1942-1946

	Conservative	Heavy	Light
Range of use	14-20 acre inches	21-48 acre inches	7-13 acre inches
Average use	17.1 acre inches	29.0 acre inches	11.4 acre inches
Yield per acre	295 packed boxes	239 packed boxes	182 packed boxes
Value of fruit	$867.30 gross p.ac.	$692.66 gross p.ac.	$535.08 gross p.ac.
Cost of Water—5 yrs.	$60.50 per acre	$103.24 per acre	$40.58 per acre

Here is tangible evidence that conservative irrigation pays good dividends.

Several orchards in the light group reduced the water used because of weak trees. The production from such trees naturally would be lighter than from normal trees.

Guides for an Irrigation Program

Here are some general rules for an irrigation program.

1. Apply water only to dry soil actually occupied by tree roots.

2. Do not apply water to soil that remains wet. Roots in soil continually wet will deteriorate and cause chlorotic—yellow—leaves, and finally defoliation.

3. Apply only enough water to penetrate as deep as the roots grow. Water which percolates below the root zone is wasted and leaches nitrates below the root-feeding area.

4. Adapt the irrigation program to soil and climatic requirements. Chart your orchard to determine variations in soil types.

5. Use a soil tube or auger to determine the actual condition of soil moisture during the irrigation season.

Cultivation

Every year, during the 21 year period, orchards in the higher profit group and reporting low cultivation costs were found next to orchards reporting high cultivation costs.

Last year, the top orchards reported an average of $27.23 per acre for cultivation. The highest cost was $61.45 per acre and the lowest in that group was $9.32. These figures are typical for every year in the study.

Records of orchards operated on the non-tillage system indicate that the first year's cost, for setting up permanent furrows and frequent spraying for weed control, is about $60.00 per acre. The second year's spraying costs about $35.00 per acre and the third year's spraying, about $18.00 per acre. In the succeeding years the cost tapers down to very low figures.

Labor Costs

Farm records of 20 years ago, just after World War I, show general farm labor received 40c an hour and tractor drivers, 60c an hour. Today,

The total production in 1946—a small crop year—was 136.2 oranges per capita.

Efficiency Hints

Here are suggestions for orchard efficiency.

Keep simple tree records for a four-year period to determine the poor, the average, and the good producing trees. One and a half hours per acre spent each year on the average sized orchard are sufficient to keep production records. Too few citrus growers keep individual tree production records or replace low-producers with good trees or improve environmental conditions so that yields will be increased.

Chart your orchard to determine variations in soil texture, depth of soil, the number of trees missing, and the number and location of diseased, gophered, or low-producing trees.

Determine if low-producing trees are the result of spots of infertile soil or due to variations in soil moisture conditions. Increased applications of fertilizer to poor spots have usually caused marked improvement in yields.

Adapt irrigation practices to variations, in soil, don't irrigate soil that is moist.

Replace all missing trees with certified scaly-bark-free nursery stock. Irrigate replants more frequently than the old established trees.

Treat all beginning stages of scaly-bark, root rot, and brown rot gummosis.

Keep a close check on gophers. Inarch gophered trees as soon as possible after injury. Water inarches as you would a young replant.

Replace all trees that have been low-producers for a four year period unless low-production is caused by soil conditions or other factors that would prevent inherently good replants from becoming good producers.

Apply between two and three pounds of nitrogen per tree per year and small applications of organic matter by cover crops or manure if the orchard is cultivated. If the orchard is under a non-cultivation system, the addition of organic matter may not be necessary.

Place fertilizer so that it will get into the soil actually occupied by roots.

Zinc sprays may be necessary to correct mottle leaf, a symptom of zinc deficiency.

Plan your pest control program with your agricultural inspector. Don't experiment with unproved methods or materials.

Cultivate only when necessary to control weeds, to prepare the soil for irrigation, pest control, picking and other necessary operations. Cultivate as shallow as practical to avoid cutting feeder roots.

Normal healthy orange and grapefruit need very little pruning. Lemons need moderate pruning to size up the fruit. More fruit is lost by "opening up" the tree to encourage inside fruit than is gained.

Provide for adequate heating equipment in good operating condition—45 heaters per acre—and sufficient storage capacity to meet any emergency. Know when and how to heat. Lighting too early wastes oil; lighting too late may cost the crop.

Learn to recognize and to control scaly-bark or psorosis, brown rot gummosis and root rot and decline.

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Infiltration Of Water Into Soils During Irrigation

(Continued from page 1)

the soil surface there was the question as to whether or not the shade might be a factor in an improved rate of water entry.

Furrows under the skirts of citrus trees, where there is shade, have long been known to absorb water more readily than furrows exposed to the sun.

There is also the factor that raindrops puddle the surface of a soil, slowing infiltration. Organic mulches and the skirts of citrus trees break the impact of raindrops.

In these experiments, some plots were provided with louvre type shades which provided ventilation and admitted rain, but broke the impact of the raindrops. Principally, the shade intercepted the direct rays of the sun. The plots were kept bare of vegetation and were compared with similar bare plots without shade.

Shade, and the breaking of the impact of raindrops, did not increase the rate of water entry. In fact, those rates were significantly lowered.

It is known that infiltration rates increase with the drying out of the soil prior to irrigation. Shading did decrease the rate of drying, and this fact is presumed to account for the lower rates of entry.

Disposal of Crop Residue

Many of the basins were periodically cropped with corn, pole beans, or peas.

The crop residue was disposed of in three ways: (1) Chopped up and left on the soil surface—or cultivated into the soil. (2) Cut off and removed. (3) Chopped up and burned on the soil surface.

The effect of leaving the residue was to increase the water pentration rate in relation to those basins where it was removed. Where the residue was burned, infiltration rates were lowered to about equal to those plots where the residue was removed.

Tillage

Some basins were periodically tilled and others were not cultivated at any time.

Planting was done merely by poking a hole into the soil with a stick, inserting seed, and covering with imported soil.

Tillage was done infrequently with shovel, hoe, and rake so there was no tendency to form a cultivation pan of "plow sole" and no appreciable tendency to break down the structure of the surface soil. Under these conditions, tillage did not have any significant permanent effect upon infiltration rates.

Tillage does bulk and permit the drying out of the soil, and, where an irrigation followed the tillage, there was a temporary increase in the rate of water entry. Usually this increase appeared to persist for possibly 15 minutes to one-half hour.

Where a two inch deep irrigation was applied just before an irrigation for measurment of infiltration rate, this temporary increase was never observed in the latter irrigation.

Fertilizers

Some commercial inorganic fertilizers are known, under certain conditions, to affect infiltration rates.

Sodium nitrate may cause an exchange of sodium for calcium on the wet, paste-like mass—the colloid—which results in a separation of the soil particles and a sealing of the soil pores, causing a decrease in water penetration.

Ammonium fertilizers may have, indirectly, much the same effect—if concentrations are such as to make the soil sufficiently acid.

In these experiments, fertilization was at a rate of 100 pounds of nitrogen per acre per application. Three fertilizers were used: sodium nitrate, ammonium sulfate, and urea. There was one application per year.

Los Angeles city water was used for irrigation throughout. It is moderately low in salts for this region, and has a favorable calcium-sodium ratio.

In these tests, neither sodium nitrate nor ammonium sulfate caused a decrease in infiltration rates when an effort was made to apply it in such a way that concentrations would not be high. When these fertilizers were spread over the soil surface just prior to irrigation, a subsequent lowering of the rate of water entry was noted in each case. The effect was greater and persisted longer with sodium nitrate.

Under these conditions, both fertilizers can be safely used with lighter applications, or with similar applications in the irrigation water, without ill effects.

Depth of Effects

There has been reason to believe that some of the effects herein described are limited to a surface crust of soil. At one time a surface crust, about ⅛ inch in depth was skimmed off all of the plots. This operation brought no change in the effects described and it is assumed that they were not limited to such surface crust.

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Spraying Liquid Insecticides, Fungicides And Herbicides By Plane Lessens Drift Problem

O. C. French

Spraying insecticides such as DDT in liquid form by airplane may greatly reduce the drifting problem encountered when spreading poisonous dust by plane.

Finely atomized spray will drift under certain conditions but spray droplets generally are larger and many times heavier than dust particles.

Spraying by Plane

There are several factors affecting the efficiency of liquid spraying by plane, some of which are beyond human control. These are wind velocity and direction, and air stability. Anything other than stable air is adverse to the deposition of small droplets.

A predominance of large droplets which have sufficient mass to overcome eddy air currents tends to reduce the efficiency of the spray solution.

It is apparent that a compromise is necessary as to the degree of atomization of the droplets.

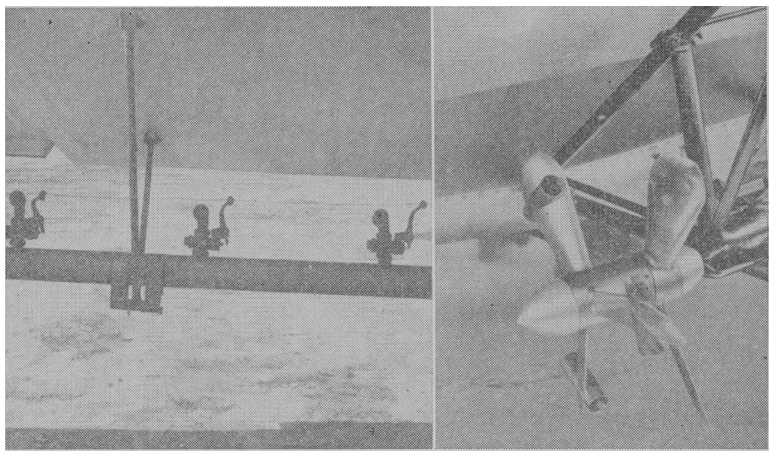
Aerial spraying is carried out relatively close to the ground and there are only short periods during the day when stable air conditions exist in this portion of the atmosphere.

The width of the spray-swath is less than a dust-swath but the actual acreage treated during a given weather period may be more. Spraying can take place while air current velocities are higher than are permissible for dusting.

The spray-swath width is influenced by the height of the plane above the ground, by the design and power of the plane; and by the location of the dispersing device with relation to the slip stream of the plane.

Spraying Devices

The planes being used for liquid application are, in general, of the same design and power of those used for dusting.



(Left) Close-up view of the nozzle arrangement of boom. Nozzles are attached to top side of boom and discharge to the rear. This location of nozzles is used to apply 2,4-D spray where large size spray droplets are desired.

(Right) A rotating type liquid dispersing device. Liquid is forced out from hub through prop blade to the little venturi tubes on each of the three blades. A screen is built into each venturi through which liquid passes and is atomized.

Two principal types of devices being used to atomize and distribute liquid sprays are those with rotating brushes and those with rotating spinners. Each type is driven by small auxiliary propellers or fan blades at speeds varying from 2000 to 3000 RPM. Liquid is pumped into the hubs or centers of the rotating brushes or spinners which whirl it as a fine spray into the slip stream of the plane where it is broken up and dispersed in the air to settle on the field.

The boom-with-nozzles type of dispersing device is much like those used on ground sprayers except that shut-off valves must be located close to each nozzle so the spray can be started quickly and be shut off sharply.

The arrangement and types of nozzles being used for the boom type sprayers are varied.

Some operators use whirl-jet cone-spray nozzles attached to the boom through a cut-off valve; others use flat-fan type nozzles.

Some builders attach a cluster of three to five nozzles per cut-off valve while others use only one nozzle per valve.

Spring loaded cut-off valves as well as ordinary cocktype valves are being used.

In most cases the booms are being constructed of streamlined strut tubing.

Pumps and Piping

Some form of pressure pump to force the liquid from multiple nozzles is necessary in order to provide uniform rates of flow and also make possible more adjustability in liquid particle size range.

The pump pressure required may vary with the type of nozzles used and with viscosity of the liquid being dispersed. Pressures now in general use vary from 20 to 100 pounds per square inch.

In most cases single stage centrifugal pumps are being used. Aluminum alloy pumps are being mounted inside of the engine cowling and are driven from a power take-off shaft from the engine by means of a multiple V-belt.

The piping system is arranged so, with a single control, the pilot can operate a two-way valve. This valve permits the discharge of the pump to be directed either into the boom or into a by-pass line leading to the liquid storage tank.

(Continued on page 4)