

Increasing Olive Fruit Sizes

thinning important in lifting fruit from
substandard grade into canning quality

H. T. Hartmann and Karl W. Opitz

Olives of canning fruit size are of particular interest to California olive growers due to the probable 50% cut in the tariff on olive oil.

In the 1949 season Mission and Manzanillo olives at Lindsay which were of canning size—Standard grade or higher—brought the grower from \$200 to \$330 a ton, depending upon the fruit size.

Olives of Standard size grade are roughly five-eighths inch in diameter or grade out 135 olives a pound. Olives which fail to reach the Standard size by harvest time are put into the Substandard grade, which can not be canned, and which were worth only \$75 per ton in 1949. Last year, in Tulare County, it cost the grower from \$70 to \$100 a ton to get the fruit harvested.

Olives for oil extraction harvested in the winter of 1949–50 brought from \$60 to \$80 a ton, while harvesting costs were about \$40 to \$50 a ton.

Trees with light crops generally produce fairly large fruits which easily reach canning size by harvest time—September 20th to November 10th. Trees with a very heavy fruit set are likely to produce a high percentage of olives too small for canning. The problem is to induce these trees to produce fruit of the more profitable size.

Within limits, the more fruits on a tree, the smaller they are and conversely, the fewer the fruits, the larger they become.

This factor usually is one which a grower can control most easily and is the basis for the age-old practice of thinning.

The immediate advantage of thinning is the increased size attained by the remaining fruits. This has been shown to be true for the olive as well as for the apple, pear, peach, and grape—where other factors such as age of tree, vigor of vegetative growth, water condition, pruning and spraying have varying influence on fruit size.

by hand and an average of 2¼ hours was spent per tree. Four unthinned trees were used as checks, four trees were thinned on June 21st, three on July 19th, and three on August 16th. There were almost seven fruits per foot of bearing wood before thinning. The thinning reduced this to four to five fruits. When the crop was harvested November 1st,

**Olive Thinning Plot, Davis, California, 1949. Mission Variety.
Individual Branches Thinned on June 30.**

	No thinning	Light thinning	Moderate thinning	Severe thinning
Tree 1				
<i>Branches girdled</i>				
Leaves per fruit	8.5	10.5	17.0	34.0
Aver. wt. per fruit at harvest Oct. 18	*2.63 grams	*2.74 grams	†3.65 grams	‡4.17 grams
Tree 2				
<i>Branches not girdled</i>				
Leaves per fruit	6.8	8.8	17.5	35.0
Aver. wt. per fruit at harvest Oct. 18	*3.03 grams	†3.49 grams	‡4.10 grams	‡4.51 grams

* "Substandard" grade, not suited for canning. † "Standard" grade. ‡ "Medium" grade.

When overloaded Mission trees in tests conducted in Butte County in 1925 to 1927 were thinned about July 1st to two or three olives per foot of twig, the following benefits were obtained: 1, increased size of fruits; 2, earlier ripening; 3, decreased danger of loss from frost and shriveling; 4, reduced tendency toward alternate bearing; and 5, the cost of thinning was not prohibitive when compared with the increased value of the crop.

During periods of low olive oil prices the benefits of thinning olive fruits are likely to be quite important.

In anticipation of this condition further tests on olive thinning were conducted with Manzanillo olives during the 1949 season.

Some heavily overloaded trees of moderate size, about 25 years old and planted 30 by 30 feet apart, were selected in an orchard northwest of Lindsay.

In general, the thinning amounted to the removal of almost 50% of the fruits from these trees. The fruit was removed

the fruits in the thinned plots were beginning to show color, while on the unthinned trees, the olives were practically all green. The average size of fruit at harvest was 16.6 mm—millimeters—in the check lot, and 17.8 mm, 17.9 mm and 17.1 mm in the thinned lots.

All thinning treatments reduced the total yield. The yield of the check trees was 286 pounds per tree. The trees thinned June 21st averaged 246 pounds, those thinned July 19th, 195 pounds, and those thinned August 16th, 181 pounds.

In every case the thinning resulted in increased fruit size. The check trees had 68% of their fruits in the Substandard grade which were unsuitable for canning. In the three thinned lots, a much smaller percentage was Substandard—38% in the plot thinned August 16th, 37% in the plot thinned July 19th, and only 33% in the plot that got the earliest treatment, on June 21st.

To determine whether the increased size would offset the accompanying re-

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Typical numbers of fruits on branches; left, from unthinned tree, and right, from thinned tree.

3. Most striking is the fact that yield was not significantly reduced at pH's as low as 3.5. The pH of the heavy sulfur strip averaged 3.7 at harvest in 1949 and total yield was no different from the checks on either side at pH 7.0.

The effect of pH on potatoes is now being studied to determine whether sulfur toxicity, rather than low pH, is responsible for some of the crop failure after sulfur applications.

A second set of sulfur soil trials in September 1948—at rates of application similar to those of the February 1948 experiments—brought out the fact that oxidation of elemental sulfur in the soil by the sulfur bacteria is dependent upon abundant soil moisture.

In the absence of any appreciable rainfall, the soil remained dry until the pre-planting irrigation in February. The pH of all treatments remained neutral until February and then dropped abruptly. The strips receiving the 2,500-pound application dropped from pH 6.8 to 4.5 in 40 days.

Many older potato fields have a reaction of about pH 6.0—due to the application of ammonium sulfate fertilizers which tend to change the soil reaction to the acid side. In the experimental field initial pH was 7.5 and 2,500 pounds of sulfur were effective on scab with no harmful effects on potato yields. It is not likely that 2,500 pounds of sulfur per acre could be safely applied to fields with pH 6.0. Many instances of poor stands and yields have been reported where sulfur applications have been too great.

Since it apparently takes two years to renovate scabby land with sulfur, it seems advisable not to crop the land to potatoes the first year after the treatment. No control of scab could be expected and the infestation of the fungus would be building up in the soil. The danger of encountering sulfur damage on the potatoes would also be eliminated.

A rotation program of potatoes with cotton as a first year crop after soil treatment is being studied but is not recommended as a control until experiments show its effectiveness.

As the potato scab problem is studied further, it may be possible with knowledge of a field's soil type and reaction to prescribe an amount of sulfur necessary to cope with scab but without affecting a field's productiveness.

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The tests on scab resistant varieties in Kern County were conducted by G. N. Davis, Associate Professor of Truck Crops, Davis.

The February 1948 investigations on 12 acres of scab infested land were made possible by the cooperation of the S. A. Camp Co., Shafter.

HYBRIDS

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proximately equal numbers of fertile and sterile plants.

By backcrossing in this manner, male-sterile plants can be propagated indefinitely and in as large numbers as desired. It is also expedient for special purposes to propagate the male-sterile mutant as a clone by rooting cuttings.

One curious and exceptional mutant—designated as *ms₃*—produces small quantities of fertile pollen in occasional flowers and can therefore be propagated by self-pollination to produce 100% male-sterile progenies.

Male-sterile mutants are useful for any project that demands large-scale cross-pollination. Their use eliminates not only the need for costly emasculation but also the possibility that contamination by self-pollination might occur if flowers of fertile plants were not properly emasculated.

Hybrid seed production is being facilitated also by the invention by an Australian worker of a simple mechanical pollen collector.

Certain hybrids are very difficult to obtain and may require the pollination of great numbers of flowers. In transferring desired characters from species of wild forms to cultivated tomatoes, it is important that accidental self-pollination of fertile plants be avoided. The contamination of such crosses is misleading and can be prevented by utilizing, as female parents, male-sterile plants planted together in a plot well isolated from other tomatoes.

Male-sterile mutants also serve efficiently to measure rates of natural cross-pollination because all fruits and seeds that they produce must issue from pollen transferred to them from surrounding plants.

Tests in progress show that rates vary to a great extent from one locality to another and are influenced by the distance between parent plants and by the varieties used as parents. These studies suggest that natural cross-pollination itself—chiefly by wild solitary bees—might be utilized in combination with male-sterile plants to supplant, or at least supplement, hand pollination as well as hand emasculation.

Differences in size and color of anthers affect the usefulness of many mutants. In hybrid seed production utilizing natural cross-pollination, those mutants with anthers most closely resembling the normal type are most desirable because they enjoy the highest rates of cross-pollination. In regard to ease of identification and pollination, mutants whose anthers are most reduced are preferable.

Mutants of intermediate effect—those designated *ms₆* and *ms₇*—might satisfy both requirements because they are sub-

ject to relatively high rates of cross-pollination and at the same time, are readily identified and pollinated.

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duced total yield and at the same time pay for the cost of thinning, the income per tree was calculated from the yield records and size grades.

After thinning and harvesting costs the early-thinned trees gave a return of \$11.56 per tree in comparison with \$7.06 per tree from the check trees, an increase of \$4.50 per tree or approximately \$225 an acre.

The trees that were thinned later in the summer, on July 19th and August 16th, failed to show any appreciable benefits. While fruit sizes in the later thinned trees were greater than in the unthinned trees, apparently the yield was reduced to such an extent by the later thinning that the increased fruit sizes failed to offset this reduced yield.

Another fruit thinning experiment with olives was conducted in an orchard near Davis in 1949.

Two Mission variety trees were used, about 25 years old and of moderate size, growing in a border row. Both trees were heavily loaded with fruit, and the thinning was performed on June 30th.

Individual branches on the same tree were given different amounts of thinning to determine how localized the thinning effect was. Fruits and leaves were counted following thinning to obtain a leaf-fruit ratio. Each treatment was given to three branches. The figures given in the table on page 4 are the averages for the three branches used. The thinned branches of one of the trees were girdled to see if girdling is necessary to localize the thinning effect.

The thinning effect was quite pronounced even when single branches on the same tree were used as the units for thinning and regardless of whether the branches were girdled.

All trees in these experiments were of moderate size with the fruiting area well distributed around the tree. In extremely large trees, especially those planted close together, where the fruiting areas are in the upper parts hand-thinning may not be feasible. It is likely that only those trees which show a very heavy fruit set by about June 25th will respond to thinning—it probably would not pay to thin the trees unless they are definitely overloaded.

The thinning operation is most important when it can lift fruit from the Sub-

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standard grade into canning quality. Merely raising the average size one, or even two, grades might not justify the thinning expense. Reducing the volume of a given crop by thinning may improve the possibilities of obtaining a more satisfactory crop the following year. Thus the tendency toward alternate bearing will probably be reduced.

Further experiments are planned on fruit thinning of olives, and it is hoped that a technique for spray thinning can be developed which will further reduce the thinning costs.

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ROT

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stored at room temperature for three days, when another reading was made.

Results of this work indicate that the application of fungicidal dusts did not effect any control of rot.

There was no consistent difference between the no-treatment blocks and the fungicidal dust treatments nor was there any difference between one or two applications of the dusts in either the field reading or in the readings from the stored fruit samples.

Almost all of the rots occurred at damaged places on the fruit such as skin cracks, worm holes, stem scars, and sun scald spots. It was not unusual to find a rotted fruit where the mold had entered exposed tissue following a fruit growth crack even though the fruit had been previously covered with a protective dust.

It is generally agreed that the incidence of rot is much greater if rains occur shortly before or during the harvest season. One explanation of this is that moist conditions are more favorable for spore production, spore germination, establishment and development of the organisms concerned.

Another idea is that rains may cause an increase in fruit growth cracks especially if the roots and other parts of the plant are in an active condition.

Since irrigation alone does not cause any appreciable increase in growth cracks, rains probably exert their effect by increasing humidity of the air. Increased humidity of the air would lessen water loss from plants and thereby cause an increase in turgidity. Such an increase might cause rupturing of the fruit skin, providing openings for infection. Such turgid fruit would also be more subject to mechanical injury during picking.

This hypothesis might explain why more secondary rot in fruit has been found in some instances from sprayed than from unsprayed plots. Since defoliation by leaf spotting fungi has been prevented, plants have been kept in an actively growing condition. This has caused an increase in the number of growth cracks and mechanical injury during picking, probably resulting in more secondary rots. Unsprayed, and therefore defoliated, plants produced fruit which was flaccid. This fruit probably had fewer growth cracks and less mechanical damage during picking resulting in less secondary rot.

Since fruit rots are correlated with wet weather during harvest season and since these fall rains usually come late in the season, any practice which would bring the crop to maturity earlier to escape these rains might be of some value for control. Plant breeders might also select for earliness of maturity so that the crop can be harvested before the fall rains begin.

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SCALES

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ducted near Woodside. Tests were made in late May on valley oaks and blue oaks which were heavily infested with the least pit scale. The treatments were each made on two trees while four trees were used as checks. One treatment consisted of a 2% light-medium emulsion-type foliage oil containing 4½% DDT, while the other treatment consisted of a 2% light-medium emulsion-type foliage oil along with one quart of 60% toxaphene emul-

Summary of Results of Dormant Oil Sprays on February 22, 1949, for Control of *Asterolecanium minus*.

	Pretreatment Feb. 21	Post-treatment Aug. 24	
	Scales/ sq. in.	Scales/ sq. in. old wood	Scales/ sq. in. new growth
5% oil—80% emulsion	7.5	0.0+	11.9
5% oil—80% emulsion			
2 # DDT—50% wettable	1.9	0.0+	10.6
5% oil—80% emulsion,			
1 qt. toxaphene, 60% emulsion	9.4	0.0+	12.5
Checks	5.0	4.4	6.3

sion—containing 1½ pounds actual material per quart—per 100 gallons of diluted emulsion.

Counts were made of the number of scales on 30 twigs from each tree, and infestations were calculated on a basis of scales per square inch of twig surface. Pretreatment counts were based on over-

The Summary of Results of Light-Medium Oil Combination Sprays on May 21, 1949, for Control of *Asterolecanium minus*

	Pretreatment May 19	Post-treatment Sept. 14	
	Adults/ sq. in. old wood	Scales/ sq. in. old wood	Scales/ sq. in. new growth
Valley oaks			
2% oil—80% emulsion,			
1 qt. toxaphene, 60% emulsion	29.4	0.0+	0.6
Check	21.9	25.6	93.8
Blue oaks			
2% oil—80% emulsion			
containing			
4.5% DDT	23.8	30.0	56.9
Check	21.9	17.1	46.3

wintering females, while counts made four months after treatment were based only on the new generation of scales. A comparison of the results showed that excellent control was obtained with oil and toxaphene, while oil and DDT gave negligible control.

Weekly band counts of crawlers were also made in connection with these tests. These counts indicated that practically no reproduction occurred following the oil and toxaphene spray, while crawler activity was not affected for more than one week after the oil and DDT spray.

Tests were also made in late July, 1949, on three valley oaks which were very heavily infested with the least pit scale. There was no apparent control on the tree which was sprayed with toxaphene alone at the rate of one quart of the 60% emulsion per 100 gallons of water. One hundred per cent control was obtained on a tree sprayed with 2% light-medium emulsion-type foliage oil along with one quart of 60% toxaphene emulsion per 100 gallons of diluted emulsion.

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