

Olive Fruiting Behavior

soil moisture during floral development studied
for possible effect on fruitfulness in olive trees

H. T. Hartmann and R. M. Hoffman

The fruiting behavior of olive trees can be affected during the early part of the flower-development period, when the inflorescences—the flower clusters—are making their initial one-inch growth.

The olive tree has a very rapid pre-bloom development of the flower parts as only about eight weeks—mid-March to mid-May—intervene between the first microscopic evidence of flower formation in the bud and full bloom.

One of the important cultural problems of the olive in California is the failure of some trees to set satisfactory crops regularly. Often they fail to bloom or bloom only lightly, or a poor fruit set may be associated with a heavy bloom, consisting largely of staminate—male—flowers. The olive bears both staminate and perfect—male and female—flowers. The staminate flowers result from an abortion of the pistil—female part—in what would otherwise be perfect flowers.

A number of environmental conditions occurring during or shortly before the period of rapid flower development in the spring might conceivably cause these unfruitful situations.

One such condition could be a deficiency of soil moisture. This occurs quite commonly in California olive orchards during years of light winter and spring rainfall, especially in low rainfall sections of the state. Many orchards in California receive no irrigation until after bloom regardless of the amount of winter and spring rainfall.

The olive will use as much water as other trees of comparable size, and since it is an evergreen, it will deplete the available soil moisture much earlier in the spring than a deciduous tree of the same size.

Tests with Sevillano

The normal spring rainfall in the Corning olive district is about 5.7" but in 1951 it amounted to only 0.31" from February 21 to April 26—when floral initiation and development occurs in the olive.

The soil moisture records on an unirrigated portion of a Sevillano olive orchard on Tehama loam soil near Corning—where the permanent wilting percentage of this soil is about 6%—showed the top two feet contained 7.5% moisture on April 6 and 8.6% moisture on April 20.

Three test plots—each consisting of 25 trees in a row running through the orchard—were established in the grove of Sevillano olives.

Plot 1 was first irrigated on April 1, Plot 2 on April 14, but Plot 3 had no irrigation until May 18—after bloom. One guard row on either side of the treated row received the same treatment as the test plot.

Rain—light, intermittent showers—in the amount of 1.9" fell on all three plots from April 28 to May 7, but failed to penetrate deeply into the soil. By April 28, the flower buds were almost ready to open, so the rainfall was without effect on the flower type.

Fruit set and yield records were obtained from each plot. The results showed marked increases in fruit set and yield with the early irrigations. Plot 1—irrigated on April 1—had a fruit set average of 3.1 per 100 inflorescences; Plot 2—irrigated April 14—fruit set average was 2.3 per 100 inflorescences; Plot 3—irrigated May 18, after bloom on May 10—had a fruit set average of 1.6 per 100 inflorescences. The average yield of the 25

trees in Plot 1 was 101 pounds per tree; for Plot 2, it was 113 pounds; and for Plot 3 the yield was only 65 pounds per tree.

Experiments with Missions

Studies in soil moisture and fruitfulness relationship were continued in 1952 when three groups of three-year old bearing Mission olive trees—which had been growing out-of-doors in soil in three-gallon containers for two years—were brought into the greenhouse on February 8.

The trees in Group 1 were kept amply supplied with soil moisture throughout the period of flower development.

In Group 2 the soil moisture was allowed to become depleted to the permanent wilting percentage; then, starting March 6, small amounts of water—just sufficient to prevent wilting—were added to each tree at three- or four-day intervals until March 20; when the trees were returned to the conditions maintained for Group 1.

Continued on next page



Left. Fruiting shoot from a Mission olive tree provided with ample soil moisture during flower development period—Group 1. Right. Shoot from tree maintained with just sufficient soil moisture to prevent wilting during the flower development period—Group 3.

OLIVE

Continued from preceding page

The trees in Group 3 were allowed to deplete the soil moisture to the permanent wilting percentage and then, starting March 6, were supplied at three- or four-day intervals with just sufficient water to prevent wilting. This continued until fruit set was completed.

The small quantities of water added to the trees in Groups 2 and 3 were applied to the top of the soil in the cans and percolated only 3" or 4" into the soil. Soil deeper in the cans undoubtedly remained at the permanent wilting percentage.

Flower Clusters

The first appearance of inflorescences occurred in all three groups of trees on February 22. By this time the trees in

Groups 2 and 3 had almost brought the soil moisture to the permanent wilting percentage. On March 20, when the trees in Group 2 were returned to high soil moisture conditions, the inflorescences on the trees in this group were about 1" long. Therefore the trees in Group 2 were under relatively low soil-moisture conditions for almost four weeks, during which time the inflorescences grew to a length of about 1". Inflorescences of trees in Group 3, also under low soil-moisture conditions made about the same growth as those in Group 2. However, inflorescences on trees in Group 1—under high soil-moisture conditions—grew to an average length of 1¾" during this same period.

The fruiting behavior of the trees grown under the three soil-moisture conditions described is given in the table on this page.

The illustration on page 9 shows the

appearance of the inflorescences from trees in Group 1, in comparison with those in Group 3 at the time Group 1 trees were in full bloom. The fewer numbers of inflorescences on the trees in Group 3, their smaller size, and delayed development are shown clearly.

The trees in Group 2 held under low soil moisture conditions for only four weeks during the first part of the flower-development period, behaved about the same in regard to flower production as the trees which were held under the same low soil moisture conditions for the entire period until fruit set.

Water Deficiency

It is apparent from the results of these studies that olives grown under water-deficient conditions—during the early part of the period when the floral parts are forming in the bud—will be less fruitful than those amply supplied with soil moisture during the floral parts formation period.

This unfruitfulness is caused by the failure of inflorescences to develop; by the decrease in the number of flowers per inflorescence; and, by the marked reduction in the per cent of perfect flowers. The latter result would be caused by an increase in the occurrence of pistil abortion under the dry conditions.

When the trees were allowed to become dry during the critical early part of the period of floral development, it made little difference in fruitfulness whether or not the trees were later supplied with water.

First Irrigation

The period when the trees were most affected by a lack of soil moisture occurred when the inflorescences were first visible until they were about an inch long. Under field conditions in California's Central Valley this would occur approximately from March 20 to April 20, varying somewhat from year to year according to the temperature.

To obtain a satisfactory fruit set—in years of abnormally low winter and spring rainfall in the Sacramento and northern San Joaquin valleys and each year in the southern San Joaquin Valley—olive orchards should receive their first irrigation before the middle of March, with subsequent irrigations as needed.

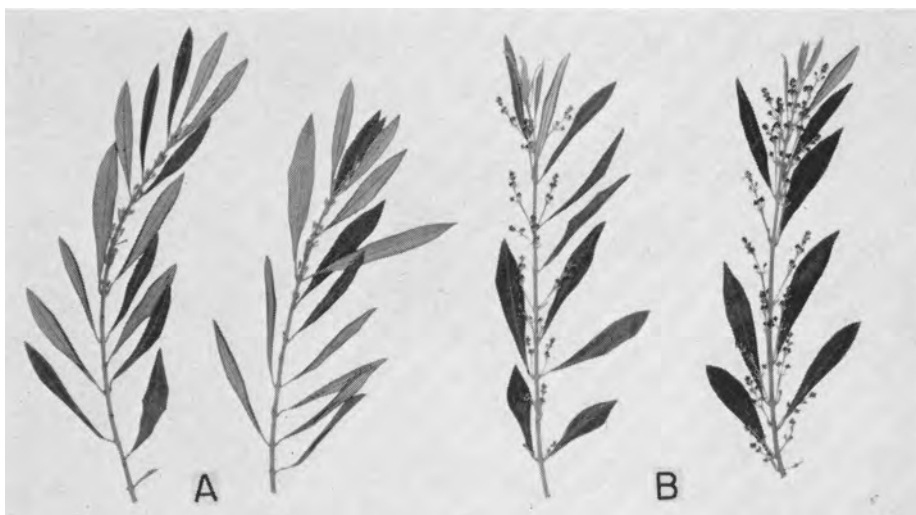
H. T. Hartmann is Assistant Professor of Pomology, University of California College of Agriculture, Davis.

R. M. Hoffman is Farm Advisor, Tehama County, University of California College of Agriculture, Berkeley.

The above progress report is based on Research Project No. 1301.

The Effect of Three Different Soil Moisture Conditions During the Period of Floral Development of Fruitfulness of Mission Olives

	Group 1 Readily available soil moisture during entire floral development period	Group 2 Soil moisture just sufficient to prevent wilting during early part of floral development period. Readily available soil moisture after inflorescences were 1 inch long	Group 3 Soil moisture just sufficient to prevent wilting during entire period of floral development
Total number of inflorescences per tree at full bloom	223	70	94
Per cent of inflorescences that dropped before bloom	3	38	28
Average number of flowers per inflorescence	12.3	7.6	8.1
Per cent perfect flowers	54.7	8.5	12.0
Number of fruits per 100 inflorescences	7.2	0.0	0.0



Early stages in the development of olive flower clusters. It is important to keep the trees well supplied with soil moisture during the stage from just before A until B. This occurs in California's olive districts from about March 20 to April 20.