Olive Flower-Bud Formation

nutrients essential to tree during March and April when flower-buds are forming tests show

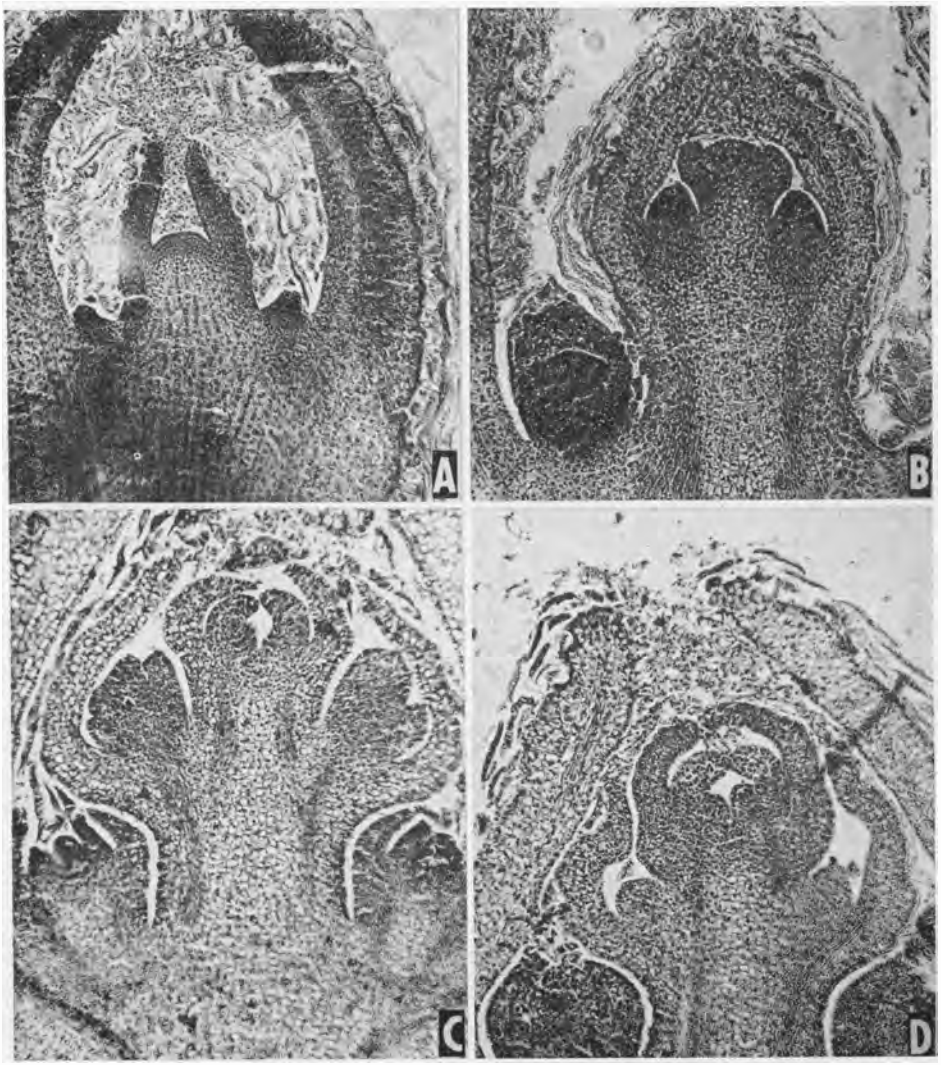
H. T. Hartmann

A critical stage in the production of olives—as in any fruit crop—is when the flower parts are forming in the buds.

All the requirements for the production of an ample number of flower buds—the first requisite for a satisfactory crop—are not known but it is reasonably safe to conclude that some of them are water, carbohydrates, nitrogen, other mineral elements and, possibly, certain unknown plant hormones. These must be available in sufficient amounts at the time the vegetative buds are ready to differentiate—to change—into flower buds.

Flower-bud differentiation in the various deciduous fruit species, such as the apricot, cherry, pear and apple, takes place sometime during the summer preceding bloom—varying with the different species from mid-June to mid-September.

The situation appears to be different with the several subtropical, evergreen fruit species. Flower-bud differentiation occurs in citrus fruits shortly before the flowers open—about the time the shoot apex emerges from the bud. In the avocado, microscopic study of the bud reveals initials of the individual flower parts only about one month before the flowers open.



Microscopic appearance of developing flower parts in the olive. Magnified 80 times. A. Appearance of vegetative buds before development of flower parts has started. B. Bud showing the first evidence of flower formation. About March 15. C. Later stage in flower development. Sepals and petals are forming. Lateral flowers are becoming evident. About April 1. D. Sepals, petals, and stamens are now evident. About April 10.

To determine when flower-bud differentiation occurs in the olive in California and to see if there is any difference among the several varieties grown or among the various olive-growing sections of the state, investigations were started by the Division of Pomology in 1937 and continued in 1946 and 1947. In 1946 bud samples were gathered from three olive varieties, Mission, Manzanillo, and Sevillano—in five localities—Corning, Oroville, Davis, Lindsay, and Riverside. Collections were made at about two-week intervals from December 7, to April 10.

In the following season, bud samples were collected from the same varieties in the same districts at about weekly intervals from February 17 to May 12. In addition, samples were collected at two-week intervals from the Manzanillo variety at Davis from June 13 until December 5. In every case the same tree was used as a source of buds throughout the season.

These bud samples were preserved and prepared for microscopic examination by the usual histological methods. The initiation of flower parts was considered to have begun when the bud terminals showed a broadening of the tip with the sepal primordia showing as slightly raised protuberances on the outer edges of the cone.

In general, the first appearance of flower parts were found in the buds during the month of March, about two months before bloom. There appeared to be no consistent differences among the three varieties studied or the localities from which the buds were obtained.

These results are in agreement with similar studies conducted in Portugal and Italy in which flower-bud differentiation was found to occur in February and March, respectively.

Two Types of Flowers

One characteristic of the olive is its production of two types of flower, the perfect—male and female—and the stami-

Approximate Dates of the First Microscopic Evidence of Flower Formation in the Buds for Three Olive Varieties in Five Localities in California

Locality	Variety					
	Mission		Manzanillo		Sevillano	
	Date of initiation of sepal primordia	Date of full bloom	Date of initiation of sepal primordia	Date of full bloom	Date of initiation of sepal primordia	Date of full bloom
	1946					
Corning	March 18	May 18	March 18	.....	March 18	May 16
Davis	March 27	May 21	March 18	May 23	March 18	May 25
Lindsay	March 12	May 10	March 27	May 17	March 27	May 22
Oroville	.....	May 17	March 27	May 14	March 18	May 11
Riverside	March 18	May 6	March 18	May 6	March 18	May 6
	1947					
Corning	March 13		March 13		March 13	
Davis	March 28		Before April 10		March 18	
Lindsay	March 4		Before May 2		March 4	
Oroville	.....		Before May 2		March 4	
Riverside	March 21		March 5		March 5	

nate—male. The staminate flower is apparently due to the abortion of the pistil—the female part of the flower that develops into the fruit.

The cause for the phenomenon of pistil abortion in the olive is not well understood. It is probably connected with the nutrition of the tree, inasmuch as the formation of the pistil occurs during April, coinciding with the principal flush of vegetative growth.

The development of the pistils in the thousands of flowers on a tree, simultaneously with the flush of vegetative growth, may be too heavy for the stored food reserves in the tree. This may be especially true if the season follows one in which the tree bore a very heavy crop which would tend to deplete the food reserves in the tree. It is well known, however, that there are pronounced varietal differences in the percentage of staminate flowers formed.

Pistil abortion, with the resultant production of staminate flowers, is not a serious problem unless it becomes excessive. If 2% to 4% of the flowers set fruit an entirely satisfactory crop will be produced. On the other hand, many cases have been observed where hardly any perfect flowers could be found in an entire orchard—the bloom being almost completely composed of staminate flowers.

Food Reserves in the Tree

There is a peak demand on the stored food reserves in the olive tree during late March and April when vegetative growth resumes at the same time the flower parts are forming.

Anything that will contribute to the accumulation of stored food reserves during and prior to this time will be beneficial. It would be desirable to prevent, if possible, an excessively heavy crop the previous year which would exhaust the tree in attempting to mature such a crop. Whenever an excessive fruit set appears, any practical program of fruit thinning will undoubtedly leave the tree in a better nutritive condition for a favorable fruit set for the following year.

To encourage the accumulation of food reserves in the tree all possible measures should be taken to maintain a maximum leaf area in good functioning condition.

Drastic pruning should be avoided, especially just following a heavy crop year when the tree is building back its stored foods.

Infestations of peacock spot, *Cycloconium oleaginum*, which cause partial defoliation of the tree will reduce the ability of the tree to manufacture carbohydrates. This fungous disease can be controlled by treatment with applications of bordeaux mixture just before the winter rains start.

Water

All growth reactions that take place in plant cells require the presence of water. In addition, water is one of the raw materials for photosynthesis. The olive tree should not be allowed to lack water during the critical time when the flower buds are forming.

Unlike the deciduous trees, the leaves on the olive are lifting water out of the soil all winter and especially so during the spring when the air temperature increases.

In years of light or no rainfall during

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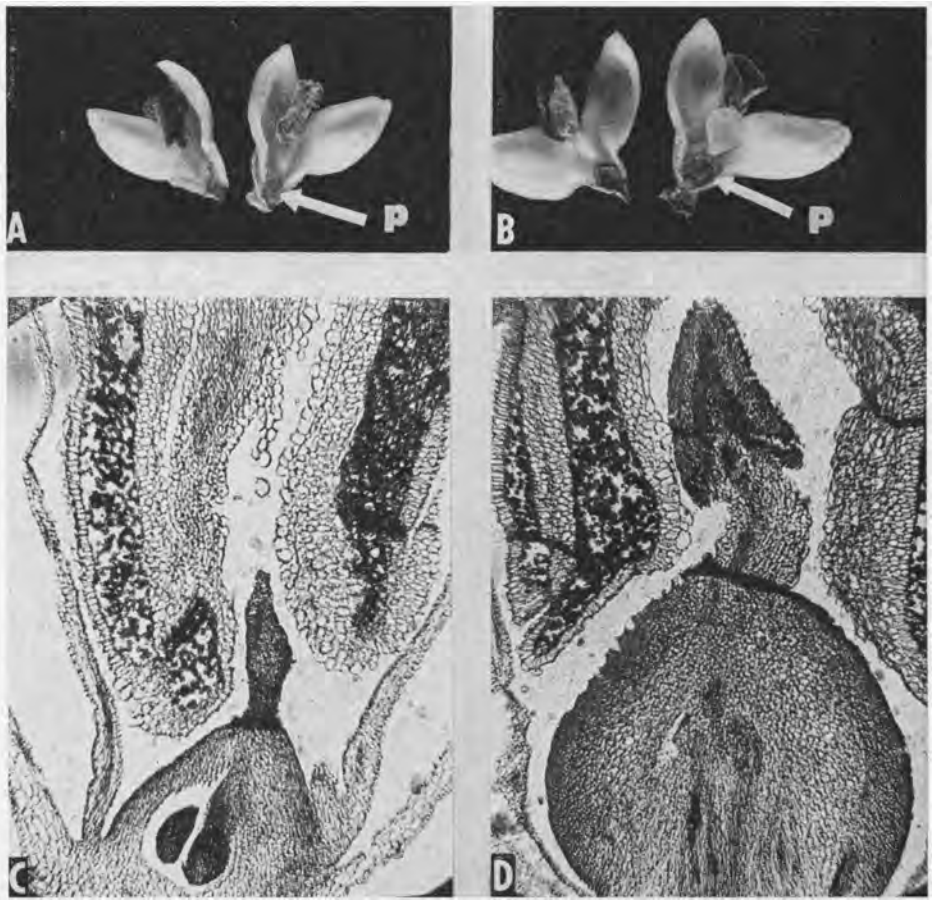

Top. Enlarged views of olive flowers at full bloom. A. Staminate (male) flower. B. Perfect (male and female) flower. (P = pistil). Lower. Photomicrographs of olive pistils (female part of flower that develops into fruit) shortly before bloom. C. Aborted pistil in staminate flower. D. Developed pistil in perfect flower. C and D magnified 60 times.

NEW PUBLICATIONS

—now ready for distribution—

Each month, new publications of the College of Agriculture are listed in this column as they are received from the press.

CALIFORNIA PLUMS: ECONOMIC STATUS, 1950, by Jerry Foytik. Exp. Sta. Cir. 398, October, 1950. An economic study of the fresh plum (as distinguished from prunes) industry, pointing out the factors that have influenced grower prices. Also discusses future trends.

THE FULLER ROSE BEETLE, A PEST OF CITRUS, by R. C. Dickson. Exp. Sta. Bul. 718, October, 1950. Describes the Fuller rose beetle, its injury, control, distribution, life history, and habits. For use by farmers, pest control operators, entomologists, farm advisors, and door-yard flower growers.

SHEEP AND WOOL: SITUATION IN CALIFORNIA, 1950 by Edwin C. Voorhies and Robert W. Rudd. Exp. Sta. Cir. 399, October, 1950. An economic study of recent changes in numbers and distribution of sheep, factors influencing lamb consumption and retail meat prices, the dependence of the California wool industry on world happenings and future trends in wool prices.

Single copies of these publications or a catalogue of Agricultural Publications may be obtained without charge from the local office of the Farm Advisor or by addressing a request to: Agricultural Publications, 22 Giannini Hall, University of California, College of Agriculture, Berkeley 4, California.

OLIVE

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the spring months—when the soil is dry—one or two early irrigations during March or April would be advantageous.

Nitrogen

The olive responds markedly to applications of nitrogen fertilizers and most growers in California make a practice of applying annually some type of nitrogen fertilizer to their trees.

If the applied nitrogen is to be available to the developing flower buds during March and April, it should be applied early enough so that winter rains will carry it to the root zone. There the fertilizer will be converted to a form available to the roots, absorbed by the roots, and translocated to the growing parts of the tree by the time the flower parts are developing.

For the commercial fertilizers the applications should be made during December or January, and for manures the previous fall.

A lack of nitrogen in olive trees is indicated by a short annual shoot growth, and small, light green leaves.

Ample nitrogen is shown by trees with dark green foliage, and a vigorous shoot growth. Continued heavy annual applications of nitrogen—exceeding two pounds of actual nitrogen per tree—to trees in the latter group may be detrimental to fruitfulness.

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

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