TABLE 3. ACREAGE OF MAJOR CROPS OF CORPORATE AND COMMERCIAL FARMS, CALIFORNIA, 1968

Crop	Farming corporations	All farms	Per cent corporate
	acres		
Corn	66,000	185,000	35.6
Other grains	662,000	1,872,000	35.3
Hay	223,000	1,864,000	11.9
Potatoes	30,000	92,100	32.5
Sugar beets	75,000	254,000	29.5
Rice	83,000	432,000	19.2
Dry beans and peas	8,000	214,000	3.7
Apples	2,000	26,361*	7.5
Peaches	19,000	113,248*	16.7
Pears	6,000	45,402*	13.2
Strawberries	2,000	8,600	23.2
Fruits N.E.S.	60,000	—	N.A.
Cotton	264,000	687,400	38.4
Grapes	91,000	500,576*	18.1
Citrus	58,000	193,498*	29.9
Tomatoes	59,000	243,800	24.2
Lettuce	64,000	102,600	62.3
Melons	64,000	71,700	89.2
Green peas	2,000	14,100	14.1
Carrots	9,000	26,000	34.6
Green beans	6,000	33,000	18.1
Vegetables, N.E.S.	107,000	—	N.A.
Other crops	157,000	—	N.A.
Greenhouse	7,000	—	N.A.

* Source: Agricultural Statistics, USDA, 1969. All other data obtained from 1964 Census of Agriculture.
N.E.S.—Not elsewhere specified, including specific fruits and vegetables.
N.A.—Not available.

TABLE 4. NUMBER OF LIVESTOCK, CORPORATE, AND COMMERCIAL FARMS, BY TYPE OF LIVESTOCK, CALIFORNIA, 1968*

Livestock	Farming corporations	All farms	Per cent corporate
	number		
Fed cattle sold	1,378,000	2,965,000	46.4
Beef cows calved	119,000	995,000	11.9
Yearling cattle sold	99,000	—	N.A.
Cows milked	40,000	857,000	4.6
Market hogs sold	29,000	230,000	12.6
Sows farrowed	687	228,000	0.0
Broilers sold (1,000)	8,000	23,090	34.6
Laying hens (1,000)	14,000	38,339	36.4
Turkeys sold (1,000)	2,000	14,337	13.9
Sheep sold	87,000	167,000	52.0

* Source: Agricultural Statistics, USDA, 1969.

viduals or partnerships; less than 17 per cent under corporation management.

Livestock

Corporations were also important in California's livestock industry (see table 4). Over 46 per cent of the fed cattle sold were fed by corporations whereas only about 12 per cent of the beef cows were maintained by corporate farms. This, as in the case of field crops, indicated greater corporate activity in the intensive high-risk-capital enterprises. The major exception was the sheep industry. The poultry industry, especially broilers and layers, involves a high degree of concentration of capital, reflecting the movement toward vertical integration in this industry.

C. V. Moore is Agricultural Economist, Farm Production Economics Division, Economic Research Service, U. S. Department of Agriculture, stationed at the University of California, Davis; J. H. Snyder is Professor of Agricultural Economics and Agricultural Economist, U. C. Davis.

Exposure of plants to ethylene gas has brought about various responses, including flower induction, change in direction of growth, accelerated fruit ripening, leaf and fruit abscission, and hastened seed germination. Research in 1967 revealed that fig fruits were stimulated to grow rapidly and mature early when exposed to an atmosphere containing 5 ppm of ethylene. The cost and inconvenience of confining a gas such as ethylene to fig trees makes impractical its application to induce early fruit maturity. On the other hand, application of a spray that produces effects similar to those of ethylene would be of great value to the fig grower. When applied as a water spray, the proprietary compound Ethrel (2-chloroethylphosphonic acid) penetrates the leaves and other plant organs and then decomposes to form ethylene, chloride, and phosphate. The results of experimentation during 1968 and 1969, described in this report, show clearly that the effects of Ethrel on fig fruit growth and maturation are like those of ethylene.

ETH

THE 20-YEAR-OLD MISSION and Calimyrna fig trees used in this study were growing at the Wolfskill Experimental Orchards, Winters, California. As shown in graph 1, growth in diameter of the fig fruit is characterized by two phases of rapid growth (periods 1 and 3) that are separated by a phase during which growth is relatively slow (period 2). Various concentrations of Ethrel in water were applied as sprays to the leaves and fruits at different times during the development of the fruit (experimental applications).

The application of 500 ppm of Ethrel early in period 2 (May 22) stimulated growth of first-crop (breba) Mission

Growth and maturity of Mission figs treated with 100 ppm Ethrel on August 1 (left) as compared with untreated fruit (right)—photo taken August 7.

REL

speeds growth and maturity of figs

fruits (see graph 1). From the standpoint of color, the fruits appeared mature but they were mealy and lacked sweetness and flavor when they abscissed six days after spraying. The ultimate diameters and weights of the Ethrel-treated fruits were only a fraction of those of unsprayed fruits when they matured on July 3.

Ethrel treatment late in period 2 of first-crop fruit growth (June 12) brought about marked stimulation in growth and maturation that occurred 14 days earlier than that of control fruits (graph 1). While all concentrations of Ethrel were equally effective in stimulating growth to the same diameters as the control fruits, the 100-ppm concentration was not sufficient to induce fresh and dry weight accumulation equivalent to that of the control (table 1). On the other hand, during a seven-day period, 250 and 500 ppm stimulated fresh and dry weight increases identical with those that occurred in control fruits during a 21-day period.

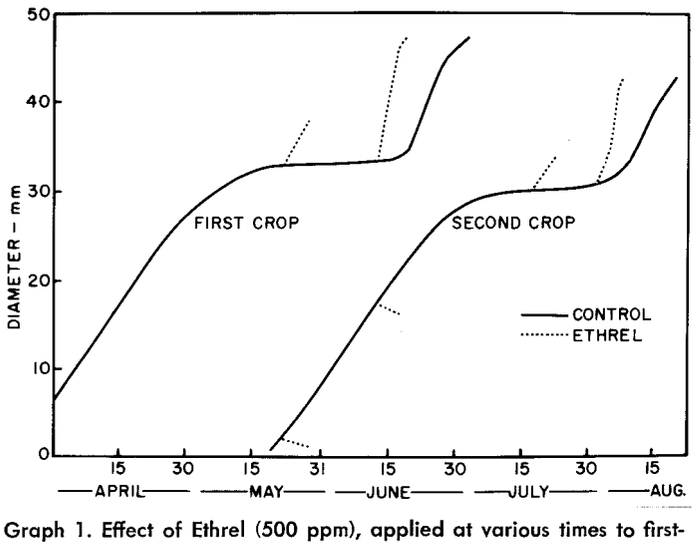
Second-crop fruits

Ethrel applied to second-crop figs, either at the beginning (May 22) or about mid-way (June 12) through period 1, inhibited growth and fruit dropped from the trees five to six days after spraying (graph 1). Application on July 17, before the mid-point of period 2, stimulated growth in diameter, color development and fruit abscission like that occurring in first-crop fruits. As with first-crop fruits, Ethrel application late in period 2 (August 1) greatly stimulated growth in diameter and maturation occurring 13 days before control fruits (see photo). Ultimate diameters and weights of the basal fruits induced to mature early by various concentrations of Ethrel were not significantly different from the control (table 2). While only basal fruits on the shoots were measured and weighed, the others responded to Ethrel in a manner similar to the response of Calimyrna fruits.

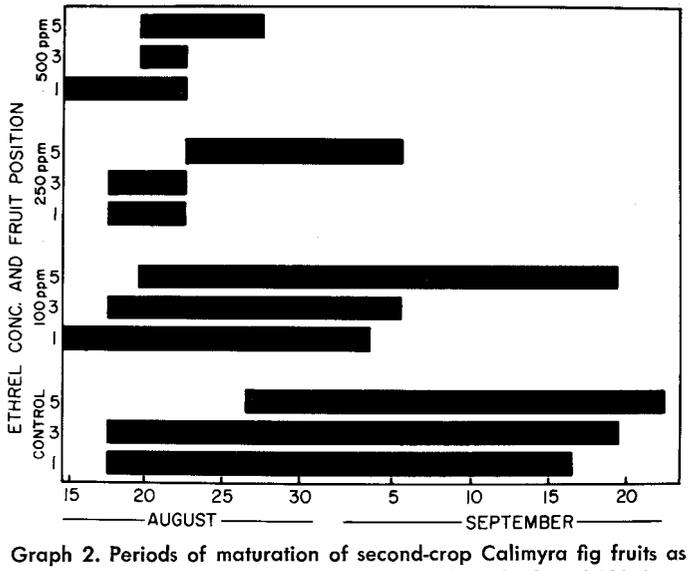
Calimyrna response

The spectacular manner in which Ethrel stimulated growth and maturation of second-crop Calimyrna figs is shown in graph 2 with delineation of periods of maturation for fruits at various positions on the shoot. Control fruits matured during the 35-day period, August 18 to September 22. While the overall period of maturation of fruits treated with 100 ppm of Ethrel was also 35 days, the periods for fruits at position 1 were shortened 10 days and for position 3, 14 days. On the other hand, treatment with 250 ppm shortened the maturation period of fruits at all positions to 18 days, and at 500 ppm, 12 days. Although these concentrations reduced the average growth and maturation period as much as 21 days, the fruits were of the same diameters and weights as the control (table 3). The diameter and weight of the third fruit from the base of the shoot were consistently greater than of fruits at other positions. In contrast to other fig varieties where progressive decrease occurs in fruit diameter from the first to the ninth node, Calimyrna fruits progressively increase in diameter from the first to the third node, followed by progressive decrease.

Only minor and inconsistent vegetative responses occurred as a result of Ethrel application. A concentration of 500 ppm applied to the Mission variety on May 22 and July 17 caused some leaf epinasty and abscission. Apical dominance of a few branches was broken following treatment



Graph 1. Effect of Ethrel (500 ppm), applied at various times to first- and second-crop Mission fig fruits, on their growth in diameter.



Graph 2. Periods of maturation of second-crop Calimyra fig fruits as affected by Ethrel application on August 13 (first, third, and fifth fruits from the base of current-season shoots are designated 1, 3, and 5).

TABLE 1. EFFECT OF ETHREL APPLICATION (JUNE 12) ON ULTIMATE DIAMETER AND WEIGHT PER BASAL FIRST-CROP MISSION FIG FRUIT*

Ethrel concentration	Diameter	Weight			Dry weight
		Fresh	Dry	Water	
ppm	mm	gms			%
	Harvested June 19				
100	46.9a	53.1b	10.4b	42.7	19.6
250	48.8a	57.8a	11.9a	45.9	20.6
500	47.3a	56.4a	11.3a	45.1	20.0
	Harvested July 3				
Control	47.1a	58.9a	11.6a	47.3	19.7

* Means within a column not followed by the same letter are statistically different at the 5% level.

with 500 ppm on May 22 and lateral buds on current-, one-, two-, and three-year-old wood produced a few millimeters of growth. No vegetative responses were noted on the Calimyrna variety.

Time of application

The data presented clearly indicate the importance of timing Ethrel applications. Applied during period 1, when cell division was progressing, it inhibited fruit growth and promoted abscission. Growth during period 2 is primarily by cell enlargement and it was stimulated by Ethrel application. However, quality of Ethrel-treated fruits equal to that of unsprayed fruits was not attained until treatment was made the latter part of period 2. To stimulate early maturation of fruits with quality characteristics equal to those of later maturing control fruits, the approximate time for Ethrel application is a few days after the time all drupelets within the fruits have turned red. This corresponds approximately to a week before the transition from period 2 to 3, and marks the beginning of rapid influx of sugars into the fruits as they grow to maturity.

It is evident in graph 1 that this stage of first-crop fruit development corresponds to about the middle of period 1 of second-crop fruit growth. Unless the spray is restricted to fruits only, the use of Ethrel on first-crop figs is precluded because it would eliminate the second-crop. Its application to fruits only has been shown to be just as effective as when it is applied to leaves and fruits. However, its use on second-crop fruits, the major and only crop of the Mission and Calimyrna varieties respectively, would seem very promising for increasing the yield of marketable fruits at reduced cost.

Figs produced for drying ripen on the tree and eventually drop to the ground. Since fruit ripening and abscission progress successively from bases to tips of shoots, the harvesting period may extend over a month or more, depending upon weather conditions. The longer the figs remain on the ground the more they are exposed to dust, dirt, and insect infestation. Therefore, the fruits are picked up by hand or machine two, three, or more times during the harvest period. It appears that the use of Ethrel would enable the entire crop to be harvested in one operation. Ethrel is not yet registered for use, and these results should not be considered as recommendations.

TABLE 2. EFFECT OF ETHREL APPLICATION (AUGUST 1) ON ULTIMATE DIAMETER AND WEIGHT PER BASAL SECOND-CROP MISSION FIG FRUIT

Ethrel concentration	Diameter	Weight*			Dry Weight
		Fresh	Dry	Water	%
ppm	mm	gms			
	Harvested August 7				
100	42.9	36.8	7.9	28.9	21.5
250	41.6	35.5	7.4	28.1	20.8
500	42.8	36.7	7.7	29.0	21.0
	Harvested August 20				
Control	42.6	36.3	7.4	28.9	20.4

* No statistical differences occurred among the fresh or dry weight means.

Julian C. Crane is Professor and Pomologist in the Experiment Station; Nasr Marei is Research Assistant; and M. M. Nelson is Laboratory Technician, Department of Pomology, University of California, Davis.

TABLE 3. EFFECT OF ETHREL APPLICATION (AUGUST 13) ON ULTIMATE DIAMETER AND WEIGHT PER SECOND-CROP CALIMYRNA FIG FRUIT (HARVESTED DURING THE PERIODS INDICATED IN GRAPH 1)

Ethrel concentration and fruit position		Diameter	Weight*			Dry Weight
			Fresh	Dry	Water	
ppm		mm	gms			%
Control	1	52.8	50.2	11.1	39.2	22.1
	3	57.8	60.0	12.1	47.9	20.2
	5	53.9	46.9	9.3	37.6	19.8
	Mean	54.8	52.4	10.8	41.6	20.6
100	1	53.0	50.6	10.9	39.7	21.5
	3	54.4	55.9	11.5	44.4	20.6
	5	50.8	44.1	10.1	34.0	22.9
	Mean	52.7	50.2	10.8	39.4	21.5
250	1	53.1	48.4	9.6	38.8	19.8
	3	54.6	54.3	10.1	44.2	18.6
	5	48.9	44.3	9.3	35.0	21.0
	Mean	52.2	49.0	9.7	39.3	19.8
500	1	53.3	51.5	10.1	41.4	19.6
	3	56.9	60.0	10.6	49.4	17.7
	5	52.2	49.3	9.2	40.1	18.7
	Mean	54.1	53.6	10.0	43.6	18.6

* No statistical differences occurred among the fresh or dry weight means of all fruit positions of a particular treatment.

Foliar zinc

ZINC DEFICIENCY is one of the most serious nutritional problems of walnut production in California, and has been very difficult to correct. The most common treatment in past years has been the use of zinc-coated sheet metal strips driven into the sapwood of the tree. This method has been laborious and expensive and has required periodic treatments (every three to four years) to maintain deficiency-free trees. In some soils, trees have responded well to soil applications of zinc, while in other soils they have responded poorly. Soil applications of zinc at levels sufficient to achieve correction have often been very expensive.

Foliar sprays of zinc materials had been considered ineffective for correcting the deficiency of walnut trees until recently. However, because of the pressing need for easier and cheaper control methods, an intensive effort was made to find effective sprays to correct walnut zinc deficiency. One experiment indicating that zinc deficiency of walnuts can be corrected with spring foliar sprays is described here.

Trees in an eight-year-old Hartley walnut orchard in Sutter County were graded visually on October 7, 1965, for leaf and growth symptoms of zinc deficiency. Thirty-four trees selected for the trial were divided into five groups. Five trees were used in each of four spray treatments and fourteen trees were left as an untreated check. The degree of deficiency of each group was essentially the same.

Applications were made with a 100-gallon hand-gun sprayer, and care was taken to achieve thorough coverage. Four treatments were applied in the spring of 1966. Three of these were resprayed in the spring of 1968. No applications were made in 1967. The treatments were as follows:

Spray Treatment		Application dates	
Material	lbs/100 gals	1966	1968
1. $ZnSO_4$ (36% Zn)	6.6 lb	4/20	
2. $ZnSO_4$ (36% Zn)	6.6 lb	4/20	5/12
+ Hydrated Lime	5 lb		
3. $ZnSO_4$ (36% Zn)	6.6 lb	4/20,	5/12
+ Hydrated Lime	5 lb	5/1	5/28
4. ZnEDTA 14% Zn)	3 lb	4/20, 5/1, 5/13, 6/2	5/7 5/28