Harvester for Canning Fruit

exploratory trials with cling peaches and Bartlett pears to evaluate feasibility of shaking fruit onto catching frame

Lloyd H. Lamouria, Richard W. Harris, George H. Abernathy, and Sherman J. Leonard

Tree structure is the greatest deterrent to the successful mechanical harvest of fruit destined for the cannery.

In the initial phase of harvesting trials —with peaches and pears during the 1956 season—the principal consideration was an evaluation of the amount of damage a fruit received in dropping through the tree, onto a catching frame and into a box. Measurements showed that more fruit was damaged in the fall through the tree than was injured in falling onto and then over the catching-handling apparatus.

A catching frame—in the developmental stages—was attached to a tractor by means of an outrigger boom. It was an inverted umbrella type with 220° opening 11′ from the center line of the tractor. A nylon cover was stretched from the center of the frame to the tips of hydraulically operated radial arms to form a 27′ diameter catching area. A sectioned aircraft innertube formed a seal at the tree trunk when the frame was closed. Since the nylon was supported only at the tree seal circle and at the end of the radial arms, the energy of the falling fruit was dissipated by the deflection of the cover. The fruit then drained to the tractor side of the tree and rolled through an opening onto a hydraulically driven conveyor belt which carried the fruit to boxes behind the tractor.

Cling peaches and Bartlett pears were shaken from the trees with long poles which had hooks on one end. This method of shaking was used because of convenience, and was not intended to exemplify future removal methods. All of the fruit from the test peach and pear trees was harvested in one picking at Davis. However, only the last picking of pears in Lake County was mechanically harvested. The fruit was graded soon after being harvested. Only those fruits which were of No. 1 quality on the tree were graded as to the severity of injury.

Amount of Injury to Gaume Peaches Harvested by Different Methods. Davis, 1956

Method of harvest	No. of fruit harvested	Fresh fruit injury* Not visible %	Major %	Minor %
Hand picked	420	95	5	0
Hand picked dropped onto catching frame	167	90	3	7
Shaken onto canvas	197	72	15	13
Shaken onto catching frame	5,092	76	15	9

* Minor skin punctures—less than ¼″ in diameter and 1/16″ deep that could be peeled out.
Major skin punctures—more than ¼″ in diameter or 1/16″ deep.

Fruit Quality Evaluation After Canning

Method of harvest	Halves without blemish* Peaches Yolo %	Pears Yolo %	Pears Lake %
Hand	96	..	96
Catching frame	60	83	64

* U. S. choice grade allows 10% of the halves to be blemished; this tolerance has not been subtracted from the above figures.

Over 75% of the peaches shaken onto the frame were free of visible injury. At Davis 79% of the mechanically harvested pears were free of visible injury, but in Lake County only 59% of the fruit was in this class.

To determine the amount of damage fresh fruit received dropping through the tree, peaches and pears were shaken—a few at a time—onto a canvas held under the tree. Other fruits were hand picked and then dropped onto the catching frame to determine the extent the catching frame damaged the fruit. From examination for visible injury it was apparent that the tree caused the most damage to the fruit. Most of the peaches and practically all of the pears that showed injury were damaged in falling through the tree. More pears were injured in the Lake County orchard than at Davis. The Lake County trees were much taller and had many horizontal branches in the lower part of the trees which obstructed fruit fall.

Amount of Injury to Bartlett Pears Harvested by Different Methods

Method of harvest	No. of fruit in sample	Fresh fruit injury* Not visible %	Minor %	Major %
Yolo County				
Catching frame				
Entire tree	994	79	13	8
Lake County				
Frame				
Entire tree	2,005	59	21	20
Top ⅔	911	51	25	24
Bottom ⅓	438	80	14	6
Onto canvas				
Top	162	58	20	22
Bottom	85	81	12	7

* Minor skin punctures—less than ¼″ in diameter and 1/16″ deep that could be peeled out.
Major skin punctures—more than ¼″ in diameter or 1/16″ deep.

Tractor mounted catching frame in development stages used in trials with canning fruit.

Injury Visible After Canning

Fruit from the Davis peach and the Lake County pear harvests were canned. The peaches showed little increase in damage before canning, but the storage and ripening of the pears resulted in a considerable increase in the visible injury.

The amount of fruit injury to mechanically harvested pears observed at harvest was a close indication of the per cent of blemished halves after canning. On the

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Defoliation of Hydrangea

chemical defoliation of hydrangea plants obtained rapidly and without injury to flower buds by prestorage treatment

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Flower buds of the common hydrangea —*Hydrangea hortensis*—are initiated during summer or early fall, but a cold period of 6–8 weeks is required to condition the buds for subsequent flowering.

The conditioning cold period can be given the plants by subjecting them to temperatures of 33°F to 40°F in refrigerated dark storage or by storing them outdoors under straw in a cool location.

If hydrangea plants are stored with leaves on them, the leaves will abscise over a long period of time. The dead leaves develop a mold—*Botrytis* sp.—which will infect the flower buds.

Defoliation of hydrangea plants before storage with ethylene gas given off by ripe apples has been used by pot plant growers in areas where apples are abundant. Some growers allow frosts to defoliate the plants but frosts can be too severe sometimes and cause plant injury or so slight that defoliation is incomplete.

Experiments to find a chemical defoliant which would be rapid in action but not destroy the flower bud—for the next year's forcing—were started in 1952. However, materials tried prior to 1956—sodium azide, phenyl mercury chloride, amino triazole, calcium cyanamide, and some others—were rejected on the basis of incomplete defoliation and undesirable aftereffects on the plants.

In 1956, tests were made with three of the most promising defoliants: Vapam, Folex, and zinc chloride. Vapam is a 31% solution of sodium methyl dithiocarbamate and was used in aqueous solutions at the rate of 2.5 ml/liter—milliliter per liter—3.75 ml/liter and 5.0 ml/liter. Folex is an emulsion containing 75% tributyl phosphorotrithiote and was used at the rate of 10 ml/liter, 15 ml/liter and 20 ml/liter. A 4% zinc chloride solution was used.

Mean Leaf Defoliation of Hamburg and Europa Hydrangeas with Various Concentrations of Chemical Defoliants

Treatments	Leaf abscission	
	In 8 days %	In 15 days %
2.5 ml/liter Vapam	100.00	100.00
3.75 ml/liter Vapam	98.43	99.41
5.0 ml/liter Vapam	99.11	100.00
10.0 ml/liter Folex	95.71	97.57
15.0 ml/liter Folex	99.34	99.34
20.0 ml/liter Folex	95.23	99.13
4% Zinc Chloride	64.18	76.74
Control	6.26	13.29

One half pint of the diluted Vapam solutions was applied to one square foot of soil, which vaporized into 10 cubic feet of air space. The plants were kept in the vapors from 4 p.m., December 17, to 8 a.m. December 18, 1956. Folex and zinc chloride were sprayed on the plants until they were thoroughly wet. Five plants of Hamburg and three of Europa were used per treatment. Counts of leaf drop were made eight days after treatment and again at 15 days after treatment. The plants remained outdoors from December 19, 1956, until January 2, 1957, when they were placed in a greenhouse with a maintained night temperature of 60°F. The plants were forced in the greenhouse, to observe whether any detrimental aftereffects developed due to the defoliants.

Leaf abscission on the Vapam treated plants was evident within 48 hours. The Folex treated plants began showing effects after 72 hours. After eight days both the Vapam and Folex treatments—all concentrations—caused practically complete leaf drop. Plants treated with zinc chloride abscised approximately two thirds of their leaves. The control plants were less than 7% defoliated. In 15 days the leaf defoliation of the zinc chloride treated plants increased to 76.7% and the control plants abscised 13.3% of their leaves.

The manner of defoliation effected by Vapam and Folex was particularly desirable. None of the foliage burned to any noticeable extent. About a day prior to leaf fall the leaves wilted somewhat indicating a moisture deficit. Then they dropped with what appeared to be a fairly normal abscission layer. This layer was quite dry with the Vapam, but remained moist for a day or so on the plants treated with Folex. A second good feature effected by both chemicals was that the young unfolding and expanding leaves dropped as readily as the mature leaves. Often young leaves are resistant to drop and must be hand defoliated. There was no visible injury to green twigs or tight buds.

The plants used in this experiment had well developed buds at the time of treatment and had sufficient cold to bring the buds to forcing stage. Shoots on which terminal buds were still tightly enclosed by terminal leaves at time of treatment, showed no bud or leaf injury from the treatments.

Some injury to the most advanced shoots appeared upon forcing. Variety Europa showed slight injury at all concentrations of Vapam but Hamburg showed only slight injury at the highest concentration.

Plants of both varieties treated with Folex—at the highest concentration—showed the same type of injury, expressed as reduced leaf size, and a slight silvering of some leaves much like smog damage. In addition, the plants treated with Vapam showing injury—particu-

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other hand, more of the mechanically harvested peaches showed injury after canning than was evident at the time of harvest. A high percentage of the peach halves showing injury had only marks in the flesh which were not apparent except upon careful examination.

In canning, each peach and pear was cut into halves. In fruit that was damaged in harvest, usually one good half remained. Some of the blemishes were removed in the peeling process and in addition, U. S. Choice grade permits 10% of the halves in each can to include blemishes. In both the peaches and the pears, a further salvage could have been realized if the blemished fruit had been trimmed and used in fruit cocktail, nectar or sliced fruit.

A tree structure that would have few limbs to interfere with fruit fall would be the first requirement if fruit is to be harvested onto a catching frame. Such a tree may be possible.

These preliminary trials are encouraging enough to warrant further testing.

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AVOCADOS

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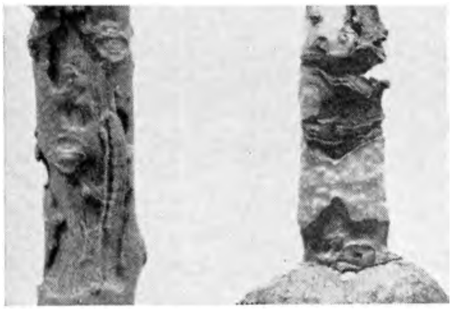
In one row of trees—approximately of the same size—six trees were sprayed for control of avocado brown mites with 50% TDE—also known as DDD—wettable powder and 15% Aramite wettable powder each at two pounds per 100 gal-



Orange tortrix injury. *Left*—girdled twig, showing larva; *right*—girdled stem of a fruit.

lons. The resulting average infestation of orange tortrix was 10.6% of the fruits, with a range of 2.0% to 21.7%.

Cuprocide—applied for control of dothiorella rot—appeared to have no effect on the orange tortrix population. Among 80 fruits picked from the untreated part of the orchard, 41.8% had orange tortrix injuries. The degree of infestation in the treated and in the untreated plots was closely correlated with the size and density of the tree and the interlacing with adjoining trees. Untreated trees that did not interlace with others—and therefore had sunlight on all sides throughout the day, and a minimum of accumulated debris—had a smaller percentage of injured fruit than treated trees with conditions favorable to the orange tortrix. Trees next to a road, and with considerable dust on the foliage, had much heavier infestations than the trees farther from the road. Apparently the dust was favorable to the orangeworm.

In an isolated row of Fuertes—where a row of trees had been removed on either side, causing the remaining trees to be less susceptible to infestation by the orange tortrix—six trees were sprayed with 50% TDE wettable powder and 15% Aramite wettable powder, each at two pounds to 100 gallons. The percentages of tortrix-injured fruit ranged from 2.7% to 7.3%, with an average of 4.4%. On six trees in the same row sprayed with 1½ pounds of 25% parathion wettable powder and two pounds of 15% Aramite wettable powder to 100 gallons, the percentages of injured fruit ranged from 3.8% to 15.1%, with an average of 8.5%.

In these tests, parathion—Aramite suspension—and particularly TDE, were effective in substantially decreasing the percentage of fruit injured by the larvae of the orange tortrix. No avocado brown mite problem developed in the treated plots, presumably because of the addition of an effective miticide to the sprays.

In view of the usual difficulties encountered by upsetting the balance of pests and their natural enemies, all practicable means of utilizing cultural measures to combat avocado worms should be considered. Damage from these pests can be decreased to a tolerable level by removing alternate trees growing under excessively crowded conditions and keeping the remaining trees open to sunlight by a certain amount of pruning, and—particularly—by removal of dead twigs and branches. Experience has shown that in orchards in which this has been done the production per acre can be expected to return to its original level in about three years. Over a prolonged period the average production has often exceeded that of the years preceding the correction of the crowded condition. Another treatment would be to cut every other tree back to the trunk and graft it to the variety that appears to be the most desirable for local conditions.

The Fuerte is not considered to be a particularly desirable variety in coastal areas because of its unpredictable bearing habits and varieties less susceptible to avocadoworms might be considered for grafting.

In an experiment extending over a five-year period—in an avocado orchard near Santa Paula—the average populations of omnivorous loopers were found to be 49% as great on the Hass variety as on the Fuerte variety and 28% as great on the McArthur variety. Observations indicate that there is a similar difference in these varieties with respect to their susceptibility to infestation by the orange tortrix.

Cultural practices such as thinning an orchard to reduce or remove conditions favorable to pests should follow technical procedures established by professional experience.

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Orange tortrix injury to avocado fruits. *Left*—injury to stem end of fruit showing typical deep holes (arrows); *right*—injury to sides of fruit, where they had been covered by foliage, with only occasionally a deep hole.

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In addition to tree structure and the catching frame itself, other factors must be considered. An effective method for shaking the fruit is needed. Fruit maturity is still a problem which must be resolved although little fruit was harvested that was overripe or immature. The problem of fruit size must be evaluated. The cost of mechanical harvesting is yet to be determined since a satisfactory method has not been worked out. In addition, the cannery operations may be complicated by the necessity of sorting a higher percentage of damaged fruit.

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