searchers have more recently shown a relationship between various species of mites present on grape and the predaceous mite, *Metaseiulus occidentalis* (Nesbitt).

The grape thrips, *Drepanothrips reuteri* Uzel, was first reported in 1926 causing damage to Tokay and Emperor grapevines in the Florin and Lodi district of the Sacramento Valley. In 1970 researchers found that damage to the berry clusters was caused by the western flower thrips *Frankliniella occidentalis* (Pergande) and not by the grape thrips.

The grape bud beetle, *Glyptoscelis squamulata* Crotch, was first found on grapevines in Las Vegas Valley, Nevada, in 1922. In 1923, it spread over the entire Coachella Valley of California and became a major pest, sometimes destroying as much as 90 percent of the crop. By 1936, the insect had become established in parts of the San Joaquin Valley.

The grape leaffolder, *Desmia funeralis* (Hubner), was apparently introduced into California in the late 19th century. In California, the larvae roll the leaves instead of folding them to make nests. Most larvae found outside California fold the leaves; a few roll them, however, and the California insect may have come from one of the leaf-rolling strains.

Before its arrival in California, the western grapeleaf skeletonizer was known to occur in southwestern United States and northern Mexico. The insect was first found infesting wild grape in San Diego County in 1941. Eradication efforts were unsuccessful, and later the California State Department of Food and Agriculture began a program to suppress and prevent the spread of the insect. Entomologists at the University of California, Riverside, have been comparatively successful with the importation and establishment of a parasitic wasp, *Apanteles harrisinae* Mues., a parasitic fly, *Sturmia harrisinae* Cog., and a viral disease. Present efforts are devoted to biological and chemical control programs by the state and the University.

The major impetus for grape pest investigation came in 1961 with the development of the University program for integrated grape pest control. The program combined desirable features of all control methods—biological control, cultural practices, and the judicious use of pesticides. The purpose of the program was to offer maximum possibilities for efficient control, high yield of quality fruit, lowest costs, and minimum environmental disruption.

Several studies have been conducted to obtain basic information related to the various insect and mite problems. In one study, for example, the presence of tydeid mites on vines increased the survival rate of overwintering predaceous mites. Researchers investigating the ecology of the grape leafhopper found that reproduction and development were regulated by environmental temperatures and photoperiods.

Currently, the University is involved in investigations concerned with chemical control of spider mites and pesticide resistance in spider mites and predaceous mites, biological and chemical control of the western grapeleaf skeletonizer, biological and chemical control of the grape mealybug, studies on the mode of transmission of the Pierce's disease bacterium in leafhoppers and transmission from various host plants to grape, the ecology of the omnivorous leafroller and orange tortrix, and the ecology of the *Dikrella* leafhopper on blackberry plants.

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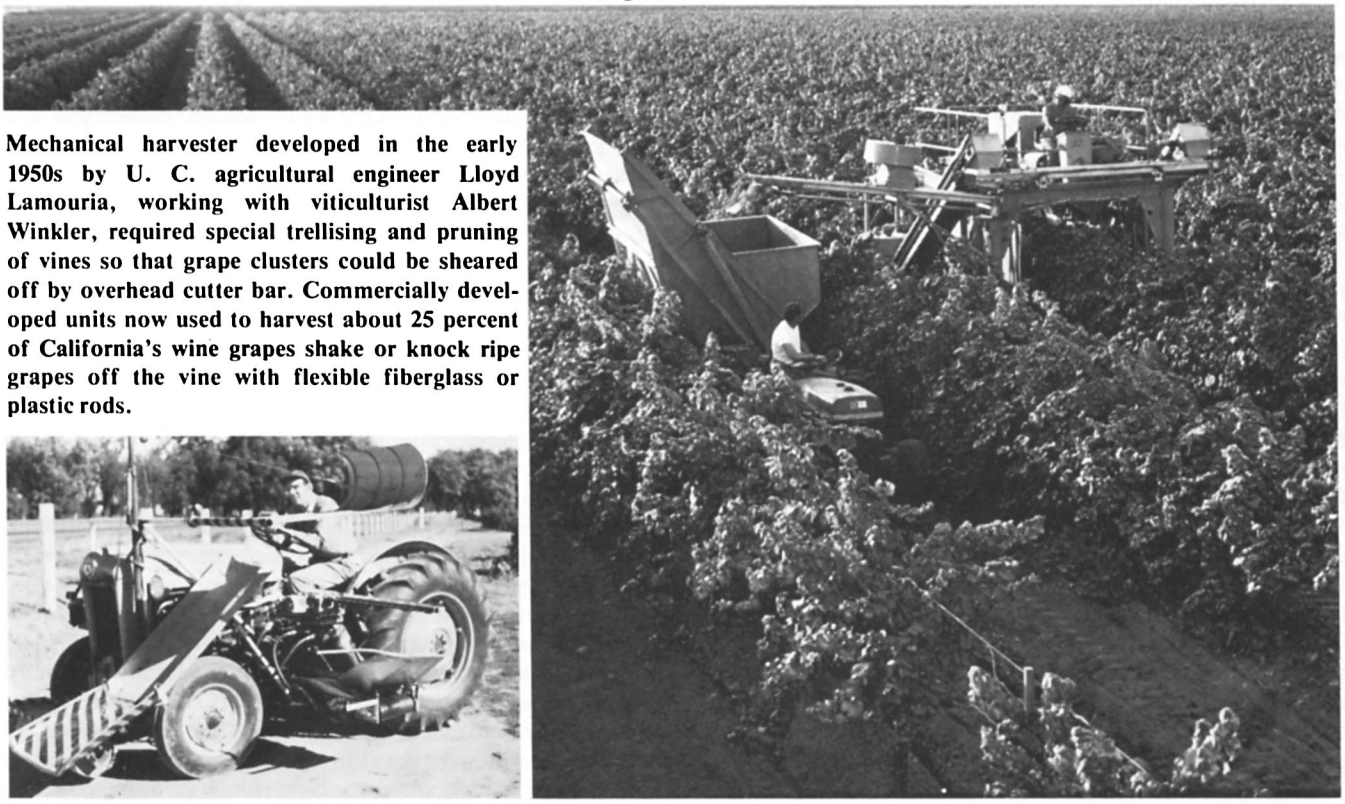
Mechanical harvesting of grapes



Mechanical harvester developed in the early 1950s by U. C. agricultural engineer Lloyd Lamouria, working with viticulturist Albert Winkler, required special trellising and pruning of vines so that grape clusters could be sheared off by overhead cutter bar. Commercially developed units now used to harvest about 25 percent of California's wine grapes shake or knock ripe grapes off the vine with flexible fiberglass or plastic rods.