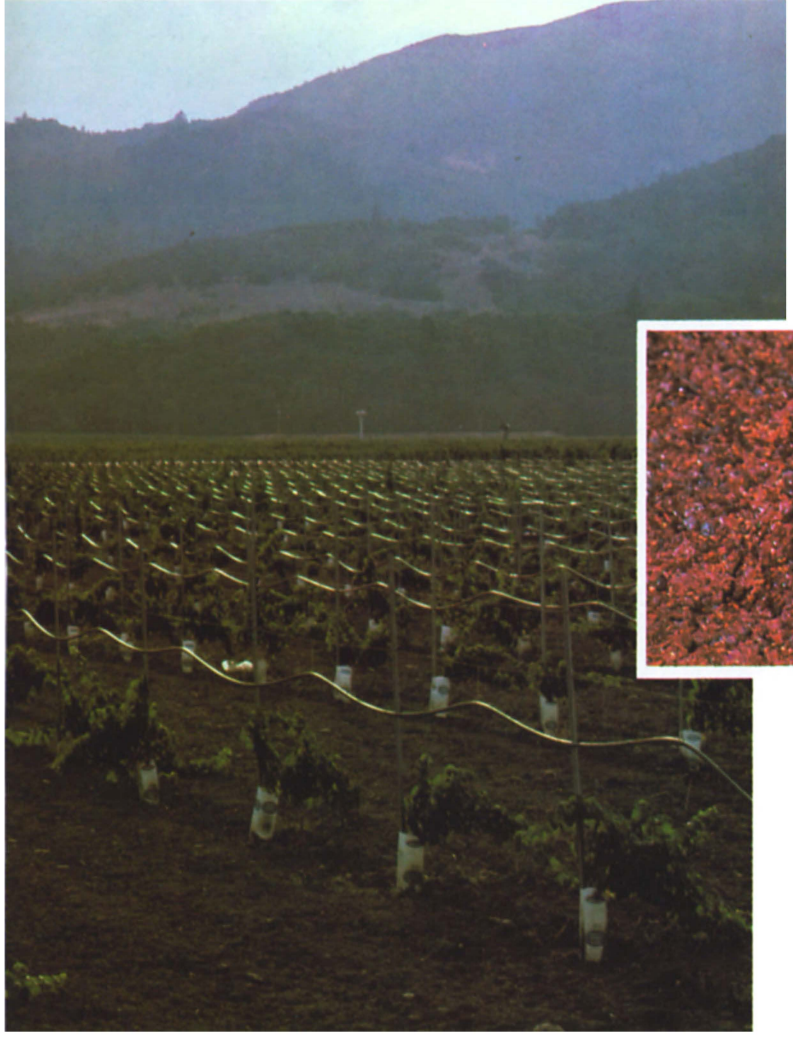

Sun-drying raisin grapes.

California leads in raisin production

Amand N. Kasimatis

The United States leads the world in raisin production, accounting for nearly 40 percent of the global crop. All U. S. raisins are produced in California, where the Thompson Seedless variety, harvested on 100,000 acres annually, constitutes 90 percent of the raisin production. This variety is distinctive, because it is dried in the sun between vineyard rows without treatment.

Raisin research in the University of California was first conducted by Professor Frederic T. Bioletti in 1913 to determine the degree of ripeness at which raisin grapes should be harvested. Bioletti's research, done near Fresno and at Davis with the two principal drying varieties, Muscat of Alexandria and Thompson Seedless, showed that increased fruit maturity enhanced raisin quality and markedly improved yield. He concluded that first-class raisins could not be made from Muscat grapes at less than 25° Brix (approximately 25 percent fruit sugars), nor at less than 23° for Thompson Seedless.

For best development, raisin grapes require long, hot, dry summers. Rains are desirable during the winter, but rainy weather during harvesting and drying may cause serious fruit damage. At least one month of clear, hot, rainless weather during August and September is needed to produce sun-dried raisins.

University research has focused on reducing damage caused by early-September rains. Bioletti suggested in 1919 that small stacks of wet raisins drying on wooden trays be sulfured to prevent spoilage, and he described methods of sulfuring with a portable hood. Present research emphasis is on earlier harvest when drying conditions are better and the hazard of rain is reduced. Efforts have been directed at developing a new, earlier-ripening seedless variety to replace Thompson Seedless. Another approach is to find ways of accelerating sugar accumulation to permit earlier harvest. A plant regulator spray applied at the beginning of the ripening period in

mid-July shows promise.

Grape dehydration began in California as a way to salvage raisins when sun-drying conditions were unfavorable. Interest remained low until about 1925 when a new type of raisin, the golden Thompson, was introduced to compete with the light-colored Smyrna raisin produced in other countries. By the late 1930s approximately 25,000 tons of golden raisins were produced each year. During the period of expansion University research elucidated principles that resulted in the design of more efficient dehydration equipment and facilities. Investigations of sulfuring, dipping, and drying procedures and their effects on the vitamin content led to improved raisin quality. From concurrent studies of insects that attack stored raisins and other dried fruits sanitation procedures and fumigation techniques were developed and refined.

The University has given special attention to the cost of establishing a raisin variety vineyard and of producing raisins through a series of studies updated every two years beginning in 1959. Sample costs enabled growers to compare expenses and identify high costs, and also stimulated better record-keeping as a means of maximizing returns on investment. The future export market for California raisins in Europe was evaluated as early as 1963 with the establishment of the European Economic Community (EEC). This subject remains a concern today with the impending entry into EEC of Greece, a major raisin producer.

The large demand for hand labor during the raisin harvest and pick-up period from late August to early October has been of continuing concern to the industry. In 1959 University investigators used time-and-motion study techniques to find ways to increase picker efficiency; they recommended the use of a tray carrier, for example. Later an analysis of mechanical aids for raisin pick-up and boxing and bulk handling methods in Fresno County led to greater handling efficiency. Overall costs, labor inputs, and hand-lifting needs were lowered. A new technique for vine-drying and machine-harvesting Black Corinth raisins was introduced in the early seventies. The resulting raisins were more attractive and had better flavor than those hand harvested and dried on trays between rows.

Studies on mechanical harvesting of Thompson Seedless raisin grapes by means of vibration after cane severance began in 1968. Severing the fruiting canes caused water loss and other physical changes in the capstems and berries that permitted machine harvest as single berries. The berries were mechanically conveyed and spread in a single layer on a continuous tray for rapid sun drying in the vineyard. Cane severance reduced mechanical damage and stickiness of raisins when machine harvested. Researchers completed an evaluation of methods for severing fruiting canes of Thompson vines in 1973. Crew productivity was enhanced by the use of pneumatic pruning equipment. This new method of harvesting and drying raisins is in an early stage of adoption by raisin growers; acceptance is slow because of the large numbers of small-size raisin vineyards.

Raisin quality has been investigated in detail since the early sixties. The sugar content of grapes at harvest and the average berry weight were correlated with airstream sorter quality grades. The airstream sorter was developed as a replacement for visual grading for quality to save time and eliminate human bias. Harvesting more mature grapes improved raisin quality, reduced harvest costs, and raised yields. The latest research showed that bloom-applied gibberellic acid increased grape berry and raisin weights but did not affect grape maturity or airstream sorter raisin grades.

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Controlled-climate research

Essentially all the controlled-climate research with grapevines in California has been done in the past 20 years. A stationary and a rotating phytotron unit became available in 1961 and 1965, respectively, for plant research at the University of California, Davis. The phytotron rooms precisely control day and night temperatures as well as humidity. Solar radiation is the source of light and can be controlled to some extent with shade fabrics, filters, and the like. More recently, large temperature-controlled water baths have been added to the rooms so that root and air temperatures can be varied independently of each other and their interaction studied.

Physiological studies have been concerned mainly with the influence of temperature and light on fruit coloration, photosynthesis and fruit and vine growth, budbreak and fruit-set, inorganic and organic composition of fruit and nonfruiting parts of grapevines, and enzymes involved in organic acid and nitrogen metabolism.

The first controlled-climate work done in California dealt with the influence of light on fruit coloration. When light was excluded from the clusters, the table grape varieties Tokay, Sultanina Rose,