

# Bacchus at the Lab Bench

California researchers bring vititechnology to the land and lead the search for a futuristic grape

BY JANET HOPSON WEINBERG

The Satyrs are silent and the dancing Maenads are missing. But scientists at the University of California at Davis are doing quite well without them. Besides, Bacchus didn't have a spectrophotometer.

"The wine industry," says A. Dinsmoor Webb, chairman of the Davis Department of Viticulture and Enology, "is changing very rapidly. Vineyard practices and winemaking techniques we are using today were unheard of 10 years ago, and, I am sure, will be obsolete in another 10 years.

"You may visit a winery in, say, France, and they'll show you a quaint little wooden building filled with casks and handpresses. But if you go out in back, behind the hill, you'll find a modern industrial plant making millions of gallons of wine a year," Webb says. And chances are good that much of the advanced science and technology used in that wine operation was developed in the United States—probably at U.C. Davis. Such shining stainless steel and glass industrial wonders can be found in other wine-producing countries as well, and are already legion in California.

The Department of Viticulture (grape growing) and Enology (wine science) is by no means the only such department, but it is the largest and most active in the United States. It was founded in 1880 and expanded after Repeal to revitalize the wilted wine industry. It can now be described as a handful of professors and 150 students in search of a new grape. That futuragrape will be bred for harvesting efficiency, selected for disease resistance and tailor-made for California sun and soil. Its conversion to wine will be carefully monitored with scientific instruments—the pale yellow or sparkling red colors measured with a spectrophotometer, the progress of its fermentation and aging mapped biochemically, its taste scored statistically. All that will remain of the *Vitis vinefera* heritage will be the genes passed down from generation to generation of wines growing on sunny European hillsides—and, of course, the traditional taste of the wines.



Photos: Michael A. Rogers

*Webb in the department wine cellar—an afficianado's fantasy of experimental wines.*

One vititechnological development that necessitates the search for new grape varieties is the mechanical harvester. A result of the combined efforts of Davis viticulturists and agricultural engineers, this monstrous, row-straddling, plastic-fingered machine enables farmers to harvest grapes quickly, at optimal ripeness. Some grape varieties, however, cannot be picked easily this way, and researchers are trying to breed them so the whole bunch will come off or the berries will drop off onto the conveyor belt. New trellising and vine-pruning techniques are also being developed to accommodate the automated field hand.

Besides being mechanically harvestable, supergrape varieties ideally would be virus-free and resistant to other vitinfirmities. Grapes are susceptible to at least 20 viral diseases. One of them, grape leaf roll, is so common (95 percent infection) and its scarlet-leaved symptom so widespread, that many Californians think grape leaves change color in the fall like maples. Other grape viral diseases come with colorful names—corky bark, fan leaf, yellow

speckle, black measles—but are just as destructive as leaf roll. Virus diseases destroy an estimated 10 percent of the potential crop each year in California, and although viral diseases are transmissible only by grafting from infected plants, once a plant is infected there is no way to treat it in the field.

A major program is underway at Davis, co-sponsored by the U.S. Department of Agriculture's Agricultural Research Service, the department of plant physiology and the Foundation Plant Materials Service, a nonprofit university corporation, to supply farmers in the United States and abroad with certified virus-free plants. ARS plant pathologist Austin C. Goheen explains that plants from more than 400 grape varieties have been heat-treated to inactivate viruses (a method adapted from sugar cane culture), then "indexed"—grown in test fields and monitored for the appearance of viral-caused symptoms. Plants with no symptoms are certified, propagated and distributed. More than 15 million plants have been propagated during the past five years from an original 44 plants certified virus-free, Goheen says. They are more expensive and require more attention than uncertified plants, but are a good investment, he says. "We will have to continue fighting viruses with this public health approach—sanitation and prevention—until some big breakthrough, like a way to find and fight viruses, comes along."

Another disease, Pierce's disease, has long plagued viticulturists (and grapes). The viticulture and enology department, in fact, was founded by vintners in the late 1880's soon after Pierce's disease wiped out the vineyards around Anaheim, then viticulture center for Southern California and now home of Disneyland. Davis plant pathologists Jaime G. Auger, Thomas A. Shalla and Clarence I. Kado just last summer succeeded in isolating the bacterium responsible for this destructive disease (SN: 6/29/74, p. 414). Davis pathologists also are studying the grape aphid phylloxera and fungal diseases such as powdery mildew and bunch rot to de-



*Goheen: Stomping grape diseases.*

velop better treatments and eventually, perhaps, to breed resistance into the new grape varieties.

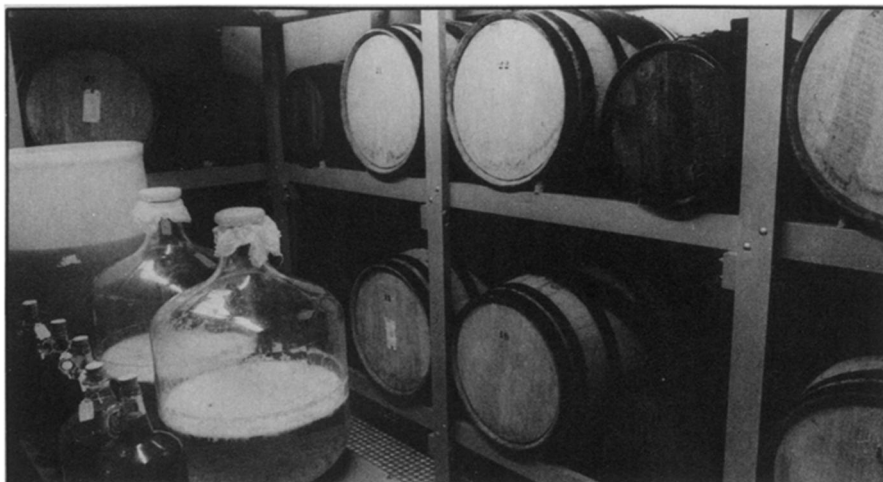
The ultimate rationale for engineering supergrapes is economic—"to provide," Webb says, "the best tasting wines at the most economical prices." Ninety-five percent of the industry production is standard competitive lines such as Gallo, Almaden, United Vintners, Paul Masson and Christian Brothers' wines. "And it is essential to have the most advanced technology—including the right grapes—to make the best tasting wines economically and with taste continuity from year to year," Webb says.

Professors and students are researching these better tasting wines with both new and traditional grape varieties. They grow their grapes and make and test their zinfidels and chardonnays and sheries in University facilities. These include more than 2,500 acres of test fields and vineyards, fermenting and distilling rooms for red and white wines, analytical laboratories and a gargantuan wine cellar—an aficionado's fantasy—stacked floor to ceiling with 10,000 bottles and casks and jugs of the experimental wines. These are tagged, tested, stored and retested during aging.

In their research toward palatable wines, Davis scientists have, for example, defined the optimum temperatures for the fermenting of different kinds of wine. Yeasts, as they consume natural grape sugars, create a different balance of esters depending on the temperatures during fermentation, and this influences the taste of the wine, Webb says. "Our professional tasting panel has confirmed that white wine is best fermented at 10 degrees C. and red at 25 degrees C."

Optimal skin-contact time—the time the grape skin is immersed in the juice before removal—has also been defined. Grape skin contains pigments and tannins that give new wine its astringency and bitterness. "We figured out the parameters of solubility of these chemicals depending on the fermentation temperature, alcohol concentration, agitation, oxygen levels and so forth," Webb says. If a winemaker wants to make a quick-maturing red wine, he wants intense color but a minimum of tannins. By knowing the optimal skin contact time, he can have both. "Now, instead of holding the wine up to the light, the winemaker can use a system that monitors pigment extraction, and then, when the right time comes, measure the wine's optical density (the depth of color) with a spectrophotometer." New red wine color, Webb says, is measured at 525 nanometers.

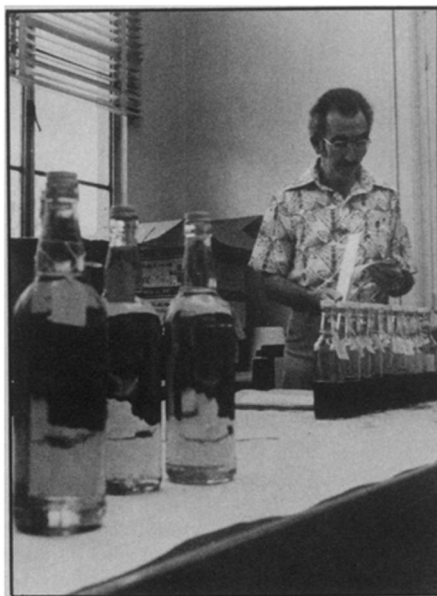
Enologists are not trying to replace all the art in winemaking with science—just tidy it up a bit. Even tasting and evaluation of the Davis wines is done statistically by a panel of enology professors and graduate students. They sit in a quiet room, at a row of booths, and wine is



*Things are brewing in the sherry lab—data on tastes and times and temperatures.*

passed through small windows. Each glass (some clear, some blackened to conceal color) has a randomly selected number on the base—to eliminate all prejudice attached to numbers. Panel members judge the wine on a 20-point scoring system for appearance, bouquet, taste and a final summation of the balance and overall quality. Comparing wines this way "can provide a powerful statistical technique," Webb says, "so that you are measuring a real taste difference at the 95 percent confidence level." But although vintners around the world have adopted much of the American wine technology, many, especially the Europeans, "don't like this approach at all. They like to stick to the single expert system," he says.

Although enology and viticulture practice are not universally technological, interest in them is high, and the Davis department has been in a boom phase. "The department has grown about four-fold in the past three years," Webb says, along with the American consumer's interest in wine. What's behind this growth? "If I could put my finger on it, I'd be



*Wine tasting: Blending art and statistics.*

a multimillionaire," he says. Market analysts credit increased overseas travel, growing discretionary income and changing attitudes about everyday alcohol consumption.

From a student's perspective, "Vit" is a great college major. One tousle-haired senior wearing cut-off blue jeans and an orange knapsack explained that many of his fellow students were "born into the business," but that many like himself have dropped in from other subjects. "It's a good thing to switch to if you're in Pre-med and getting B's or if you can't pass quantum mechanics. It's scientific but fun. Besides, working at a winery is interesting. And healthy. You're out in the sun working with the soil part of the time, and sometimes in the lab or plant."

Academic booms that follow economic ones can end in busts, though, and it hasn't been a vintage year for California vintners. The recession has cut into wine sales and speculative investing by "smart money from New York" has resulted in potential overcropping and excess winery capacity. Webb foresees cuts in department research funds following the absorption of the California Wine Advisory Board by the Wine Institute on June 30. Vintner members of the former group assessed themselves one cent a gallon on wines marketed in California for advertising and research. "But assessments are voluntary under the reorganization," Webb says, "and I am really dubious that they will come up with the same level of funding."

Back to Bacchus for a moment. When he travelled from land to land bringing viticulture and orgiastic festivals, he was gratefully received. (Of course, the few who resisted, like Pentheus and Lycurgus, were driven mad or torn limb from limb.) Will vitotechnology and scientific winemaking, carried forth by modern researchers, become the universal practices? Says Webb: "I think there is and will continue to be a place in the spectrum of wines for all types, from technologically produced to hand-blended artistic creations." □