mant treatments, a trial was conducted in which a set of 12 vines was treated with either sodium arsenite or dinoseb in 1979 but not in 1980. Disease severity on these vines in 1980 was no different from the untreated controls, indicating that the effect of dormant treatments lasted only one season. Furthermore, even though disease incidence in plots treated during dormancy was low in 1979, the inoculum (active pycnidia) increased to a level comparable to that in untreated plots by the spring of 1980 before treatment.

In these trials a significant correlation ($R = -0.51$) was observed between an increase in disease severity and a decrease in vine yield. Vines treated with captan, dinoseb, or sodium arsenite had 3, 6, or 10 percent higher yields, respectively, than untreated controls in 1979. When disease pressure was significantly higher in 1980, the same three treatments had 8, 14, or 15 percent higher yields, respectively, than the controls.

Although yields of treated vines were consistently greater than untreated vines, statistical differences ($p \leqslant 0.05$) could not be demonstrated. Further investigations are needed to determine if our inability to demonstrate statistically a significant yield response to chemical treatment is related to a low potential for damage by this pathogen, our measurement of disease severity, or inherent variability in fruit weights with inadequate sampling.

In conclusion, phomopsis cane and leaf spot disease can be controlled by chemical treatments. Dormant application of either sodium arsenite or dinoseb is apparently effective in reducing the inoculum and disease, but there is no carry-over effect to the following season. When properly applied before rain, captan is also effective in suppressing disease symptoms. Although there is a correlation between disease severity and vine yield, the effect of chemical treatments on yield is less clear.

Sodium arsenite and dinoseb did not induce phytotoxicity in these experiments. Both chemicals can damage vines if improperly applied, however, and label directions should be strictly observed. There are some restrictions by wineries on the acceptance of grapes from vines to which sodium arsenite has been applied.

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Botrytis rot on grape (7X lifesize). Jack Kelly Clark

Vineyard cultural practices may help reduce botrytis bunch rot

Steven D. Savage ■ Mary Ann Sall

Two-wire trellising and midseason hedging help minimize botrytis bunch rot, possibly by influencing the vine's microclimate.

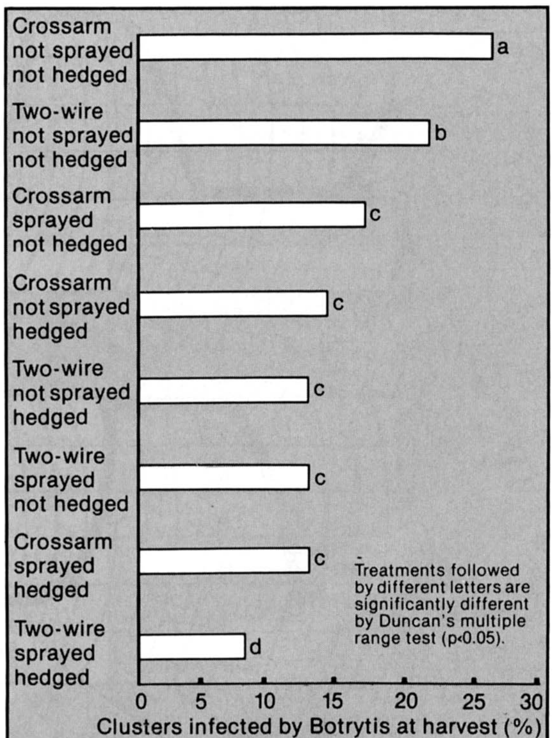
Botrytis bunch rot is the major fruit rot of grapes in the cooler regions of California. Highly susceptible cultivars, such as Chenin blanc, White Riesling, and Zinfandel, sustain moderate damage in most years, but when rains occur before harvest, major losses can occur on these and even on other more resistant cultivars. Damage by the disease is associated with loss of quality more than with actual loss of yield, and many commercial contracts specify infection levels (usually measured as percent "rot" by weight), above which loads can be rejected. While debate continues on an appropriate criterion for rejection of infected grapes, the need to develop reliable and more effective methods of disease control and management remains acute.

The most common control for the causal fungus, *Botrytis cinerea*, on grapes in California has been the application at bloom time of the systemic fungicide benomyl. In some cultivars this procedure has consistently reduced the level of "early botrytis," the name given to infections that appear before any fall rains. Some reduction in disease incidence attibutable to bloom-time treatment is still apparent at harvest, even in seasons when late rains intensify the development of botrytis bunch rot. Other chemical control strategies involve applications of contact fungicides (such as captan) throughout the season.

A complication, now becoming more important in California, is the appearance of benomyl-resistant isolates of *Botrytis cinerea* in many vineyards. This development and uncertainties about registration of alternative chemicals have motivated this study of other control options.

Development of botrytis bunch rot has long been known to be influenced by microclimatic factors, such as temperature and humidity. It was hypothesized that various cultural practices—for example, the type of trellising—could lead to the formation of canopy microclimates that were less conducive to bunch rot. Our experiments were designed to test the potential use of certain standard vineyard practices for botrytis bunch rot control.

Although many vineyard practices might be expected to influence the microclimate in which the fruit develops, this study was limited to three pairs of options, which are currently used by growers and were considered a practical first step in this research— crossarm or two-wire trellis; midseason hedging or no hedging; and spray or no spray.



Effects of vineyard practices on botrytis bunch rot, Yountville, California, 1980.

Options studied

In standard cordon-trained vineyards, one trellis wire runs at the level of the cordon, and one about 2 feet above it. A variation reported to increase canopy sun exposure is the addition of a plastic or metal "crossarm" that holds two upper wires 18 inches apart at the top of the stake. These wires support the shoots as they begin to bend towards the ground, and thus more of the foliage remains above the fruit level.

Midseason cane pruning or hedging of vines, practiced in certain instances for harvesting convenience, appeared to be a method of altering the canopy microclimate. When the fruit begins to soften (véraison), shoot growth slows; thus, hedging the overhanging canes at that time opens up the lower part of the canopy and allows little regrowth before harvest. This would improve air circulation and possibly reduce air humidity within the canopy, which in turn could affect *Botrytis* development on the fruit. In our experiments the canes were hedged using a sickle-bar hedger. This procedure reduced the average cane length from 100 to 63 inches and left a 3-foot foliage-free region underneath the canopy.

For comparison, a bloom-time spray of benomyl and captan in tank mix (according to label directions, which require the use of benomyl in tank mix with a registered contact fungicide) was included among the treatment combinations in the field plot. The fungicides were applied on 25 May 1980, when less than 10 percent of the clusters were in bloom. Commercial equipment and application rates were used (over-the-vine boom sprayer, Benlate 50 W at 1.5 pounds per acre with captan 50 W at 4 pounds per acre).

Results

In the 1978 and 1979 seasons, we tested trellising and hedging options in small blocks in a Yountville, California, Chenin blanc vineyard; results were sufficiently encouraging to test these practices on a large scale. During the 1980 season, the experiment was set up in the same vineyard in replicated blocks, which were 12 rows wide for each hedging regime and 6 rows wide for each trellising variation. Fungicide treatments were applied to blocks 3 rows wide.

The two-wire trellis, bloom-time spray, and hedging procedure were each associated with a statistically significant reduction in the level of infection when compared with that in vines subjected to crossarm trellis, but with no spray, and no hedging (see graph). The combination of any two of those three treatments resulted in nearly identical levels of disease; however, vines with two-wire trellis that were also sprayed and hedged had the lowest level of disease—a level significantly lower than that in nonsprayed or nonhedged crossarm or two-wire trellis blocks.

The benefit of hedging as a practical strategy for reducing bunch rot is complicated by the fact that a delay of maturity of 1°Brix (percent soluble solids) was observed in the hedged vines.

These experimental results are an encouraging indication that in some vineyards appropriate choices of cultural practices may play a role in minimizing bunch rot losses. The hypothesis that the cultural practices influence rot through changes in canopy microclimate is currently being tested, based on analysis of microclimate data recorded in this and other experiments.

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