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Central Coast Vineyard News

University of California Agriculture and Natural Resources Cooperative Extension

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Smoke Taint of Wines

Exposure of wine grapes to smoke from forest and rangeland fires can lead to off tastes in the resulting wines that is typically referred to as "smoke taint". Wines affected by smoke taint have been described as having the sensory characteristics of smoky, burnt, ash, smoky bacon, or ashtray. Although first recognized as an issue in wines from 2003 in Australia, other areas in the world (Canada, Greece, South Africa and California) have experienced smoke taint when fires have been in close production to vineyards. In California, the extended drought has increased tree stress in forested areas and along with high fuel loads has increased the potential for wildfires in many areas of the state. When combined with steep topography and optimal climatic conditions, these factors can produce fires that can burn for extended period of time.

Fires release substantial quantities of gases, volatile organic compounds, particular matter and smoke. Smoke is an aerosol of small particulate matter and liquid droplets that carry organic compounds. The actual composition depends on fuel type, the temperature of the fire, and the wind conditions. The compounds in smoke primarily responsible for the taint are the free volatile phenols. Of the compounds identified in smoke, guaiacol and 4-methylguaiacol have been associated with contributing to the development of smoke taint in wines from smoke exposed grapes.

Research has shown that when vines are exposed to smoke at different development stages, that the grapes and resulting wines can differ in the presence of smoke related compounds. The highest impact was when vines were exposed to smoke from the period from 7 days post veraison through harvest (see table 1).

Table 1. Periods of sensitivity to smoke exposure that result in smoke aroma compounds in wine.

Grapevine Growth Stage	Potential for Smoke Uptake
4 inch shoots	Low
Flowering	Low
Pea size berries	Variable (low to medium)
Beginning of bunch closure	Variable (low to medium)
Beginning of veraison to 3 days post veraison	Variable (low to medium)
From 7 days post veraison to harvest	High

(Kennison et al. 2011)

For smoke exposed vineyards the presence of smoke-related compounds such as guaiacol and 4-methylguaiacol can be analyzed in grape berries, grape juice, leaves, and wine. The levels of these compounds present in grape berries or juice can indicate if the fruit has been exposed to smoke. There are low levels of these compounds that can occur naturally in the berries. Both guaiacol and 4-methylguaiacol are mostly present in bound forms. The analysis determines the free fraction of these compounds that are present. The degree of potential smoke taint is generally correlated with their concentration. Although berry testing can be used to indicate a potential issue with smoke taint, fruit and wine processing has been shown to greatly influence the intensity of smoke-exposed characters in wines (see table 2).

Table 2. Techniques to reduce smoke-related aromas, flavors and compounds during handling and processing grapes and wine.

Technique	**Details**
Hand harvest fruit	Minimize breaking or rupturing of the skins as long as possible
Exclude leaf material	Grapevine leaf material can contribute smoke related characteristics when in contact with fruit and juice
Leaf plucking and water wash of grapevines	Canopy leaf plucking followed by high-pressure cold water wash in the vineyard can remove ash however water wash to entire canopy (including leaves) can accentuate smoke compounds in fruit
Maintain integrity of harvested fruit	Fruit maceration and skin contact with juice can lead to higher concentrations of smoke-related compounds
Keep fruit cool	Fruit processed at 10°C had less extraction of smoke- related compounds compared to fruit processed at 25°C
Whole bunch press	Has been shown to reduce the extraction of smoke derived compounds particularly in whites
Separate press fractions	Smoke characters could be minimized in the first 400L/t when combined with fruit cooling. Free-run juice can contain less smoke characters
Conduct fining trials pre-fermentation	Carbon, PVPP and isinglass have shown variable effectiveness in reducing smoke effect but are not selective. Fermentation management requires further consideration after fining
Consider yeast selection	Some yeast strains can alter smoke-related aromas, flavors and chemical composition of wine
Minimize fermentation time on skins	Wine fermentation that reduces skin contact time can reduce smoke aromas and flavors

Consider addition of oak chips and tannin	Oak chips can reduce intensity of smoke characteristics through increased wine complexity
Reverse osmosis of wine	Reverse osmosis can be effective in smoke reduction however smoke-related characteristics found to return in the wine over time
Market wine for quick sale	Smoke-related characteristics can evolve in bottle over time as wine ages

(From Brodison 2013)

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