

Successful management and mitigation of smoke exposed grapes: A needs assessment of the Pacific Coast grape and wine industry

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In recent years, the grape and wine industry in the western United States has experienced repeated smoke exposures from wildfires. These have resulted in wines with characteristic off aromas and flavors that have come to be known as smoke taint. There are examples of smoke tainted wines from at least five of the past ten vintages from California, Oregon or Washington State; all three states produced affected wines in 2017 and 2018. Generally, the impact of smoke exposure is regional, affecting vineyards near the fires, but atmospheric conditions can result in smoke impacting distant grape production areas. Both types of smoke exposure have resulted in [smoke impacted wines](#).

While much discussion and some research has occurred, researchers are inundated with requests from grape growers and winemakers who wish to prevent this problem. Unfortunately, more questions than answers remain. Most of the published research has been conducted in Australia and is not directly applicable to West Coast fires. Impact of fire event, smoke composition, grape variety and measurement tools are not well understood. Additionally, significant misinformation and enduring myths regarding grape smoke exposure remain:

- That ripe/overripe (or pre-veraison) grapes are not sensitive to smoke exposure;
- That washing grapes before processing will remove smoke aroma compounds from berry skins.
- That enzyme additions during winemaking release bound smoke aroma compounds
- That bound smoke aroma compounds do not contribute to smoke taint.

None of these myths are true, and all of them persist.

We were awarded a USDA-NIFA-SCRI planning grant to determine gaps in current knowledge and to develop a robust research program to address the priorities and knowledge gaps identified in industry stakeholder need identification meetings. Below are the top responses to the questions posed during these meetings, which were held in early 2020 to establish priorities

for research. Priorities from the three meetings were consistent among the Pacific coast states. Knowledge resulting from investigation of these priorities will enable the grape and wine industries to successfully manage problems associated with grapevine smoke exposure.

1. Most important fact to know about smoke taint

- The specific smoke exposure marker compounds and their sensory threshold levels in various varieties. This knowledge would contribute to strong contracts that protect the sustainability of the grape and wine industry.
- How to remove smoke exposure marker compounds without further impacting the quality of wine.
- Standardized, reliable and affordable testing methods to determine smoke exposure risk to grapes and wine.

2. Beneficial measurements and guidelines to drive vineyard management when a smoke event occurs

- Establish rejection thresholds for smoke exposure markers in the vineyard for wineries and crop insurance.
- Determine at what point in grape development the fruit is most vulnerable to smoke exposure.
- Determine the relationship between characteristics of a smoke event such as intensity, duration, proximity, and particle size to grape and wine impacts.
- Establish how fuel type (wildfire vs. house vs. chemical) alters the response in grapes and wine.
- Develop a quick and effective test in the vineyard and predictive tool for risk assessment.

3. What types of data - analytical measurements - would benefit grape and wine producers?

- Determine the key compounds that contribute to smoke taint aromas in different grape varieties and wine.
- Industry requires a rapid, standardized, reliable test that could be administered in the vineyard or winery.
- Consumer threshold and rejection levels for smoke taint by variety.

4. Winery operation-specific information and solution needs

- Treatment of damaged fruit or wine while protecting the quality of the final product.
- Rapid, accurate smoke exposure marker compound testing from vineyard to winery.
- Consumer detection and rejection threshold levels for smoke taint.
- Winemaking SOP's by smoke exposure level or risk management protocol.

5. Economic impacts

- Determine the cost of remediation treatments in the vineyard or winery.
- Crop insurance: its role in smoke exposure risk assessment/compensation and cost.
- Estimate the impacts of smoke events on tourism and the local economy.
- Develop strategic responses to long-term brand perception for the grower and the winery.

6. Disseminate research findings and other information to stakeholders:

- Launch a website or web portal to provide the industry with updated research findings.
- Email
- Regional associations and industry meetings.
- Information dissemination via Extension means at the end of the project.

These needs identified by stakeholders in the Pacific Coast states are achievable, although actionable information will require extensive research driven by robust experimental design. In addition, many of the research objectives are interdependent and must follow an interwoven timeline. For example, it will not be possible to determine the cost of vineyard or winery treatment until accurate smoke taint marker compound thresholds have been determined and the effect of processing on those thresholds have been identified. What follows is the outline of an effective research plan informed by the preceding industry needs assessment and current research findings. In this way, we will provide the wine industry with the answers they require to remain productive and sustainable in the face of increasingly intense and extensive wildfires.

RESEARCH TO ADDRESS INDUSTRY NEEDS

In order for research to be applicable to the grape and wine industry, standardized methodologies are necessary. Shared methodologies will add value across all studies by ensuring the comparability of research results. **A specific objective of the proposed SCRI grant is to develop methodology for grape sampling in the vineyard, small-scale winemaking and for analysis of targeted smoke compounds.** Small-scale winemaking for smoke exposure risk will be designed to be predictive of larger-scale operations. In the event of a smoke event, the researchers will incorporate exposed grapes into related research projects for that year.

An additional objective of the proposed SCRI grant is to determine sensory thresholds in wine for various grape varieties, a clear need expressed by the grape and wine industries.

Establishing thresholds will support risk management in the vineyard and in the winery. Further, thresholds will direct development of effective mitigation techniques as they will provide target levels for viticultural and winemaking practices and techniques. The relative efficacy of these practices and techniques can be demonstrated against the threshold limits.

Smoke exposure occurs in the vineyard; a major focus of this proposal is **evaluation of risk and preventative and mitigative measures of smoke exposure in the vineyard**. Appropriate measurements in the vineyard including the development of sensors for remote smoke exposure risk assessment will be included in this objective. Tom Collins (WSU), Anita Oberholster (UC Davis) and Elizabeth Tomasino (OSU) have been collaborating in these areas for several years. Much of their current work focuses on determining which compounds cause smoke exposure quality issues in grapes and wine. Additional projects consider barrier sprays in the vineyard that may or may not protect grapes from smoke.

Industry stakeholders expressed the value of an economic lifecycle analysis for smoke exposure issues. Such information could inform vineyard managers in deciding whether treatment against smoke taint would be economically sustainable. Thus, another **objective of our proposal will be economic modeling of risk in the vineyard**. It will be possible to measure smoke exposure risk in the vineyard and relate this to berry chemistry and to thresholds in the wine.

Finally, a plan will be put in place to **share research results from the grant research objectives with stakeholders**. Outreach activities will reach stakeholders throughout the Pacific states, and will include hands-on workshops, webinars, field days, newsletters and other published works. Annually, research plans, activities and preliminary outputs will be presented to an advisory board of industry stakeholders for feedback.

Priorities revealed during the stakeholder meeting indicate that much more work than can be covered in a single USDA-NIFA-SCRI grant will be required. Researchers are actively working to secure funding to address additional priorities outside the scope of the current grant proposal. While that search is ongoing, funding of the proposed grant will support the research plan outlined above and will make significant headway in providing solutions to the grape and wine industry in an era of intense wildfires.