2023 Grape Day
April 4, 2023 | Corvallis, Oregon
Grapevine Red Blotch Virus: Lessons Learned and Future Directions

The Oregon Wine Research Institute

2023 SYMPOSIUM PROCEEDINGS

Oregon State University

Program Schedule

8:30 AM – 9:00 AM	**Registration Check-In and Refreshments**
9:00 AM – 9:15 AM	**Welcome and Introductions** *Dr. Staci Simonich, Dean and Reub Long Professor, College of Agricultural Sciences, OSU*
9:15 AM – 10:15 AM	**Clean Plant Materials to Protect the US and Oregon Wine Grape Industries** *Dr. Maher Al Rwahnih, Plant Pathologist, UC Davis and Director, Foundation Plant Services* *Dr. Elizabeth Savory, Plant Health Program Manager, Oregon Department of Agriculture*
10:15 AM – 11:00 AM	**Interactive Poster Session** Interact one-on-one with scientists and students conducting research at the OWRI and other partner locations. Posters feature research findings that are in-progress across a wide array of topics within viticulture, enology, and economics. ***See following pages for poster number and abstracts.***
11:00 AM – 12:00 PM	**Grapevine Red Blotch Virus Epidemiology and Vector Biology** *Dr. Achala KC, Assistant Professor of Plant Pathology, OSU-SOREC* *Rick Hilton, Senior Faculty Research Assistant, OSU-SOREC* *Dr. Vaughn Walton, Professor of Horticultural Entomology, OSU*
12:00 PM – 12:45 PM	**Lunch**
12:45 PM – 1:45 PM	**Viticultural Practices to Ameliorate Grape Red Blotch Disease Impacts in Oregon** *Dr. Alec Levin, Associate Professor of Viticulture & Director, OSU-SOREC* *Dr. Patty Skinkis, Professor & Viticulture Extension Specialist, OSU*
1:45 PM – 2:00 PM	**Break/Poster Session**
2:15 PM – 3:00 PM	**Enological Practices to Ameliorate Grape Red Blotch Disease Impacts in Oregon** *Dr. James Osborne, Professor & Enology Extension Specialist, OSU* *Dr. Elizabeth Tomasino, Associate Professor of Enology, OSU* *Dr. Michael Qian, Professor of Flavor Chemistry, OSU*
3:00 PM – 3:15 PM	**Sign ODA Pesticide Credit Forms** *Attendees to sign at registration desk, must have ODA license number available.*

Enology and Sensory Chemistry

Grape and Wine Economics

Pest and Disease Management

The Influence of Nitrogen, Potassium, and Magnesium Vineyard Applications on Vine Nutrient Status and Productivity

Santosh Kalauni[1], R. Paul Schreiner[2*]

[1]Graduate Research Assistant, Department of Horticulture, Oregon State University, 4017 Ag & Life Science Bldg, 2750 SW Campus Way, Corvallis, OR 97331. [2]Research Plant Physiologist, USDA-ARS-HCRL, 3420 NW Orchard Ave, Corvallis, OR 97330.

*Corresponding Author: paul.schreiner@usda.gov, 541-738-4084

The supply of mineral nutrients is essential for optimal vine growth and fruit production. We studied the impact of nitrogen (N), potassium (K), and magnesium (Mg) fertilization on nutrient status, productivity, and fruit composition over two years in western Oregon vineyards. The N-trial in Chardonnay utilized three rates of soil-applied N. The K-trial conducted in a K-deficient Pinot noir vineyard had four treatments, three rates of soil-applied K and a single foliar treatment. A Mg-trial in a Mg-deficient Pinot noir vineyard included three rates of foliar-applied Mg. Each treatment was replicated four times using a randomized block design at each vineyard. Results in Chardonnay showed that leaf blade and petiole N status at bloom and veraison were elevated to greater extent as the rate of N increased, although minor variations occurred among tissue and time. Yeast assimilable nitrogen in must increased with increasing rate of N in year 1, but was similar in year 2 at medium and high rates of N. Soil-applied K increased leaf blade and petiole K at bloom and veraison in Pinot noir in year 2, but foliar K applications did not. However, all three added K treatments increased K in woody canes at dormancy. In the Mg trial, both the low and high rates of Mg applied to the canopy elevated leaf blade Mg status by veraison and reduced the extent of Mg-deficient leaf symptoms developing in late summer, but petioles did not respond to Mg fertilization. In all three trials, neither vine size nor yield were increased thus far by fertilizer additions. In addition, cluster size, berry size and must maturity indices have yet to be altered by N, K, or Mg additions. It will be interesting to see if productivity, yield, or fruit composition will be altered in the future.

Funding: NIFA-Specialty Crop Research Initiative

Nutrients and Wine Grape Yield: A Meta-Analysis

Alejandro Abarca[1*], Patty Skinkis[2], and A. John Woodill[3]

[1]Graduate Research Assistant, Department of Applied Economics, Oregon State University, 213 Ballard Extension Hall, Corvallis, OR, 97331; [2]Professor and Viticulture Extension Specialist, Department of Horticulture, Oregon State University, 2750 SW Campus Way, Corvallis, OR, 97331; [3]Research Associate, College of Earth, Ocean, and Atmospheric Science, Oregon State University, 101 SW 26th St, Corvallis, OR, 97331

*Corresponding Author: abarcaa@oregonstate.edu, 541-737-1398

Wine grapes are an important specialty crop grown globally with economic importance in the US. Since most grapes are grown for wine, it is essential to understand how different nutrients and field-level management decisions impact growth during the season, and ultimately, the final yield and quality. Though there is significant literature on the phenology of grapevines, including the role of nutrients and climate, research on the effects of nutrients and weather on wine grape productivity is limited. This study aims to bridge the gap between economics and viticulture by providing a comprehensive literature review on the impacts of wine grapes with vine mineral nutrient concentrations and vineyard environmental variables. Additionally, the study extends recent modeling efforts to estimate an econometric fixed-effect model using environmental and Pinot noir field-level data to investigate how nutrients affect end-of-season yield. The modeling results show a 26% increase in end-of-season yields with an increase in nitrogen during the growing season. We also provide estimates for additional nutrients, such as potassium. The model provides a general framework for understanding the marginal effects of grapevine mineral nutrient concentrations on the yield that can be applied to other grape cultivars. Finally, the study presents a useful tool for estimating final yield by modifying different nutrient levels and weather variables. The results of this research will help growers improve field-level decisions on vineyard nutrient management that impact final yield.

Funding Support: USDA-NIFA Specialty Crop Research Initiative award number 2020-51181-32159 for the High-Resolution Vineyard Nutrition Project

Climate Change Impacts on Grapevine Phenology for Willamette Valley Pinot Noir

Louis M. Delelee[1], Patricia A. Skinkis[2]*, A. John Woodill[3]

[1]Faculty Research Assistant, [2]Professor and Viticulture Extension Specialist, Oregon State University, Department of Horticulture, Oregon Wine Research Institute, 2750 SW Campus Way, Corvallis, OR, 97331; [3]Research Associate, College of Earth, Ocean, and Atmospheric Sciences, Oregon State University, 101 SW 26th St, Corvallis, OR, 97331

*Corresponding Author: patricia.skinkis@oregonstate.edu, 541-737-1411

Climate change is a growing concern for wine grape growers around the world. Increasing temperatures may accelerate grapevine development, which in turn could result in changes to the timing of key phenological stages, final crop quantity and quality. Many researchers have explored the relationships between grapevine physiology and temperature-based phenological models. However, these models perform inconsistently from one region to another, especially when models that were calibrated in one context are applied to others where factors that limit grapevine growth differ. In this study, we utilized temperature-based phenological models applied to observed phenological dates from 2012-2021 for 18 vineyards across the Willamette Valley for model calibration. Model performance was assessed using Root Mean Squared Error, model efficiency, and adjusted R-squared. Calibrated models were then used to project phenological dates from 2020-2100 under four climate change scenarios. High emissions scenarios indicate that bloom, véraison, and harvest will occur anywhere from three to five weeks earlier in the growing season. As véraison and harvest shift earlier, ripening will likely occur under warmer temperatures which could impact yield and berry composition. Precipitation events during bloom may also become more likely as bloom shifts earlier in the growing season, which can affect the quality of fruit set and final yields. Additionally, harvest dates shifting earlier in the growing season will likely lead to harvests under higher temperatures. However, budburst dates are less affected by increased temperatures as they show little change even under high emission scenarios. These results represent a valuable tool for Willamette Valley grape growers as they anticipate challenges and make informed decisions to address potential climate change impacts in the future.

Funding Support: Northwest Center for Small Fruits Research, Oregon Wine Research Institute, Oregon State University Viticulture Extension

Wildfire Smoke Exposure to Grapevines – Current Understanding and Future Directions

Suraj Kar[1], Ricky Clark[2], Joseph DeShields[3], Alexander Levin[4*]

[1]Postdoctoral Scholar, [2]Research Technician, [3]Faculty Research Assistant, and [4]Associate Professor, Oregon State University – Southern Oregon Research and Extension Center and Department of Horticulture

*Corresponding Author: Alexander Levin, alexander.levin@oregonstate.edu, 541 930 8411

Wildfires are common across five continents – North and South America, Europe, Africa, and Oceania. Changing global climate patterns have exposed large swaths of grape growing areas to increasingly hotter and drier climates, which further exacerbated the probability of wildfires. United States, especially the West Coast, has seen a steady increase in larger wildfire events over the last four decades. Wildfire smoke is a complex mixture of hundreds of compounds in both particulate and gaseous states. These compounds include oxides of carbon, nitrogen, and sulfur; toxic gases such as methane, ammonia, and free ozone; volatile organic compounds such as phenols; and metal ash. These compounds can cause direct or indirect effect on grapevine physiology and when absorbed by berries can result in a typical off flavor in wines called 'smoke taint'. So far, smoke taint remediation efforts in wine have largely been undertaken at the winery level with varied success – some techniques have included adding ameliorants such as clay and activated charcoal, addition of tannins, advanced filtration techniques, blending, and different pressing methods. However, little investigation has been done at the vineyard level interrogating the interaction between wildfire smoke and its long-term impact on grapevine health and production. The objective of this current research project therefore is to establish a connection between wildfire smoke exposure, climatic and vine physiological variables, wine quality traits, and wine sensory characteristics over multiple growing seasons to develop potential vineyard mitigation strategies. This project aims to establish smoke exposure thresholds and develop risk prediction models of wildfire smoke impact by coupling a continuously operating vineyard-based network of air quality sensors with periodic fruit sampling during the season. It will also test novel sprayable food-grade films to develop potential protective measures against exposure to wildfire smoke.

Funding: USDA-NIFA-SCRI agreement number 2021-51181-35862

Soil Type Influences Pinot Noir Growth and Yield Under Willamette Valley Dry-farmed Conditions

Mathew R. Lange[1], Andy Gallagher[2], R. Paul Schreiner[3] and Patricia A. Skinkis[4]*

[1]Graduate Research Assistant and [4]Professor and Viticulture Extension Specialist, Department of Horticulture, Oregon Wine Research Institute, Oregon State University, 4017 Ag & Life Sci Bldg, 2750 SW Campus Way, Corvallis, OR
[2]Soil Scientist and Consultant, Red Hill Soils, 6320 NW Mountain View Dr, Corvallis, OR 97330
[3]Research Plant Physiologist, USDA-ARS Horticultural Crops Production and Genetic Improvement Research Unit, 3420 NW Orchard Ave, Corvallis, OR 97331

*Corresponding Author: patricia.skinkis@oregonstate.edu, 541-737-1411

Oregon's Willamette Valley typically has ample precipitation and fertile soils, allowing growers to produce wine grapes without much water or nutrient inputs. Many vineyards in the region are dry-farmed, but growers wish to understand how soil type influences vine performance to best manage vineyards in an everchanging environment. To better understand the relationship between soil type and vine performance, a 3-year observational study (2020-2022) was conducted in a dry-farmed Pinot noir vineyard containing three soils derived from different parent material. Soil moisture, vine water stress, tissue nitrogen (N), vegetative growth, and yield were monitored in each soil type: Dupee (sedimentary), Saum (volcanic), and Woodburn-Willamette (glacial deposit). Differences in soil type impacted vegetative growth and yield each season. Vines in the glacial deposit soil had higher tissue N at veraison, which may be physiologically related to higher pruning weights, leaf area, and yield. Conversely, the lowest tissue N at veraison was in the volcanic soil, which had the lowest pruning weights, leaf area, and yield. Soil moisture was inversely related to canopy size and yield. The volcanic soil had the highest soil moisture at both 18" and 36" depths, while the glacial deposit soil had the lowest. However, lower soil moisture did not result in higher leaf water potential (greater stress) in the glacial deposit soil. Vines in sedimentary soil had 21% lower leaf water potential than vines in the glacial deposit soil, which were the greatest and least water stressed, respectively. This decoupling of vine water stress and soil moisture suggests that soil depth, water holding capacity, and rooting depth impact vegetative growth, yield, and how we should interpret soil moisture data. Results from this study showcase how site-specific characteristics (soil type and depth) affect vine performance and can help growers design appropriate floor management strategies in dry-farmed vineyards.

Funding: Oregon Wine Board and Erath Family Foundation

First Year Soil Health Impact of Till vs. No Till Vineyard Alleyway Practices

Chisom I. Molokwu[1], Mathew R. Lange[2] and Patricia A. Skinkis[3]*

[1,2] Graduate Research Assistant,[3]Professor, and Viticulture Extension Specialist, Oregon State University, Department of Horticulture, Oregon Wine Research Institute, 4017 Ag & Life Sci Bldg, 2750 SW Campus Way, Corvallis, OR 97331

*Corresponding Author: patricia.skinkis@oregontate.edu, 541-737-1411

Soil health may influence vine productivity and grape composition; however, impacts are not well known. Soil health indicators include chemical, biological, and physical properties. These properties can be altered by vineyard floor management practices (VFM) such as tillage. Understanding how VFM practices impact soil health indicators will help growers improve their management practices to achieve greater sustainability. Herein, we present research that was conducted to assess the impact of vineyard till and no-till practices on soil health indicators across three soil types after one year of application. We worked within an established VFM trial where till and no-till treatments were applied to alleyways in 2021 across three soil types, including Saum (volcanic), Dupee (sedimentary), and Woodburn-Willamette (glacial deposit). To evaluate soil health parameters, soil samples were collected in May/June 2022 in the till and no-till plots at 6 inches depth. The soil was analyzed for organic matter, total carbon, total nitrogen, wet aggregate stability, CO_2 respiration, pH which are components of the OSU Soil Health Panel. Results show no difference in soil physical properties, like soil compaction and wet aggregate stability between the VFM treatments. Some differences were observed in soil biological properties, such as CO_2 respiration, which was lower in soil from tilled plots compared to the no-till plots. However, there was no difference in soil organic matter between VFM treatments. Soil chemical properties like pH, nitrogen and carbon did not differ in treatments. There were not major impacts on soil health indicators in the first year after implementing tillage. This study suggests that while VFM can impact soil health, the effect may not be immediately apparent and may depend on tillage methods, other vineyard management practices, and time. Further research is needed to understand the long-term impact of these practices on soil health and grape production.

Funding: Agricultural Research Foundation

Rootstock Performance during the Unusual 2022 Growing Season

Jeremy D. Schuster[1] and Patricia A. Skinkis[2]*

[1]Graduate Research Assistant, [2]Professor and Viticulture Extension Specialist, Oregon State University, Department of Horticulture, 4017 Ag & Life Sci Bldg, 2750 SW Campus Way, Corvallis, OR 97331.

*Corresponding Author: patricia.skinkis@oregonstate.edu, 541-737-1411

Mature (>20-year-old) Pinot noir (PN) vines, both own rooted and grafted onto 19 rootstocks were evaluated for growth and yield performance since 2019. The 2022 season proved challenging for Willamette Valley growers, and effects were similar in the rootstock trial. A frost event in mid-April 2022 led to some primary bud loss. Cool temperatures followed delaying bud growth until early May. From April through June, the vineyard received 30% less heat units (GDD_{50}) and 10" more precipitation compared to 2021. Fruitfulness (inflorescences/shoot) was tracked as a proxy for potential primary shoot losses. Fruitfulness was 1.4 inflorescences/shoot across all PN-rootstock combinations, 12% lower than the prior three-year average. Rootstock did not impact PN performance after the frost event. Early season growth was differentially impacted by rootstock, like prior years. PN grafted to 140R had nearly double the leaf area index of Riparia Gloire (RG) at bloom, and all others had similar leaf area index. PN grafted to 1616 and RG had the greatest difference in dormant pruning weights at 0.53 and 0.15 lb/ft, respectively, like the three years prior. Early season rainfall contributed lack of water stress by late August. Only PN grafted to 101-14 and RG experienced mild water stress in 2022, as measured by stomatal conductance. By comparison, PN grafted to 3309, 101-14, RG and S04 experienced mild to moderate water stress in 2021, a drier season. Although concerned about yield reduction due to frost, we observed 80% higher yield across all PN-rootstock combinations compared to the prior three years. Contributing to this was a 76% increase in cluster weights. High yields and later onset of veraison led to higher titratable acidity and lower pH at harvest compared to the prior three years. Regardless of the atypical season, the primary impact of rootstock was on vine vegetative growth.

Funding: Oregon Wine Board and Erath Family Foundation

Developing a Spray Induced Gene Silencing Method for the Control of Grape Powdery Mildew (*Erysiphe Necator*)

Britt Eubanks[1*] and Laurent Deluc[2]

[1]Graduate Research Assistant, [2]Associate Professor, Department of Horticulture, Oregon Wine Research Institute, Oregon State University, 2750 SW Campus Way, Corvallis, OR, 97331

*Corresponding Author: britt.eubanks@oregonstate.edu, 541-737-4356

Spray Induced Gene Silencing (SIGS) is a new technique for gene silencing without genetic modification by the exogenous application of double-stranded RNA (dsRNA) and activation of the RNA-interference (RNAi) pathway in the host. Downregulating specific plant susceptibility genes can lead to broad-spectrum resistance to pests. Our project aims to develop a methodology to silence a group of grapevine susceptibility genes (Mildew Locus O) to induce resistance to the fungal pathogen *Erysiphe necator* (Grape Powdery Mildew) via application of dsRNA products. We identified unique long dsRNA sequences corresponding to six specific MLO genes of the clade V, which are associated with grapevine powdery mildew susceptibility. By root-soaking tissue-cultured plantlets with a 10 µg/mL dsRNA solution, we successfully validated the expression in three gene targets via real-time PCR analysis (VitviMLO3, 6, and 17), suggesting a silencing mechanism that is optimum seven days after the dsRNA incubation. We are devising a new experiment to test the resistance abilities of tissue-cultured microvine plantlets when challenged with *Erysiphe necator* following the silencing of VitviMLO3, 6, and 17. Seven days after the root soaking, leaves of the tissue cultured plants will be detached and inoculated with GPM (E1-101 inoculum). These leaves will be scored for infection by area of disease and disease progression during the following fourteen days. We aim to see reduced infection in response to expression changes. Along with the resistance assays, we are exploring potential nanoparticles to assist in the delivery and efficacy of the applied dsRNA molecules via aerial sprays in greenhouse plants. This research will explore whether our specific genetic sequences can invoke increased GPM resistance, and potentially lead future research into the translation of this modern biopesticide tool for growers.

Funding Support: Northwest Center for Small Fruit Research

Developing an RNAi topical application to combat Grapevine Red Blotch Disease (GRBD)

Christian Mandelli[1,3*], Laurent Deluc[2,3,4]

Graduate Research Assistant[1] and PhD Student[1], Associate Professor[2], [3]Department of Horticulture and [4]Oregon Wine Research Institute, Oregon State University, Corvallis, OR 97331.

*Corresponding Author: christian.mandelli@oregonstate.edu, 541-908-6597

Grapevine Red Blotch Virus (GRBV) is a harmful pathogen for the wine sector. The uncertainty in the vector uniqueness makes pest management strategies ineffective, forcing growers to adopt expensive and time-consuming vines replacement. The lack of extensive studies on the molecular interactions between GRBV and grapevine is also a barrier to developing emerging technologies like RNA interference (RNAi)-based crop protection. This technology consists of a foliar application of pathogen-derived dsRNA that triggers the RNAi mechanism, a major plant immune response against pathogens, including viruses. Two components are essential for successful protection via RNAi-based application, i) the dsRNA sequence(s) that show the greatest silencing efficiency of the targeted pathogen activity, and ii) the nanomaterial that facilitates the uptake and consequently, improves systemic silencing. We conducted a series of experiments to address these two puzzle pieces. First, we identified, via Small-RNA Sequencing, nine regions of the GRBV genome, also called "hotspots", that produce a significant proportion of GRBV-derived small interfering RNAs (siRNAs), indicative of RNAi responses during the early phases of GRBV infection in grapevine. Second, we have successfully validated Carbon Dots contribution to help small interfering RNA enter intact grapevine cells. We also proved that siRNAs were released in the cytosol of grapevine cells after the delivery, which is critical for optimized silencing efficacy.
Based on these preliminary results, we have defined three main research objectives: i) Identify the best hotspots-derived siRNA candidates to induce sterilizing immunity in GRBV (+) plants, ii) validate Carbon Dots' potential to improve protection and uptake of dsRNA *in planta*, iii) determine the optimal siRNA:CD formulation for maximizing systemic silencing in GRBV (+) grapevines. The expected outcomes will provide the foundational knowledge to grape growers for developing a cost-effective and pathogen-specific alternative to limit GRBV impact in vineyards.

Determination of recognition threshold for "ashy" off-flavor caused by thiophenol: Phenol mixtures in smoke affected wine

Emilie Etchart[1], Jenna A. Fryer[2], and Elizabeth Tomasino[3*]

[1]Undergraduate Research Assistant, [2]Provost Fellow, and [3]Associate Professor, Department of Food Science and Technology, Oregon State University, 3051 SW Campus Way, Corvallis, OR, 97331

[*]Corresponding Author: elizabeth.tomasino@oregonstate.edu, 541-737-4866

With the prevalence of wildfires in wine regions around the world, the flavor profile of wines has been negatively affected, causing an uncharacteristic "ashy" flavor. Smoke that reaches a vineyard transfers volatile compounds from the smoke into the grape. This then leads to wine with smoky, burnt, and dirty aromas, along with this unique ashy finish. All descriptors are considered detrimental to quality. Although previously thought to be caused by the volatile phenols found in wood fire smoke, recently a new class of compounds has been found to be a main causative agent. Thiophenols have been found in elevated levels in smoke affected wines that, when in combination with the smoke phenols, lead to smokey and ashy flavors. There is no sensory threshold information currently available for thiophenols in wine. The goals of this work are to determine at what concentration of thiophenols and phenols when present in Pinot Noir the wine is considered "ashy". Using an adaptive staircase procedure with a yes-no paradigm, the recognition threshold levels of thiophenols and phenols were determined. In addition to determining the threshold level of these compounds, this work desired to investigate potential differences in individual recognition sensitivity to these compounds. Previous work has reported that there is a sect of the population that is unable to perceive smoke-related attributes in wine and that those who do perceive them have varying sensitivities. To understand further these varying sensitivities to smoke related flavors, additional demographic and food consumption information was collected to observed if threshold clusters arise based on these factors. With wildfires becoming an ever more apparent issue, this research can be used to determine economic thresholds for wine production and targets for risk decision making.

Funding Support: USDA – Agricultural Research Service (ARS) #2072-21000-570-00D and NIH #1S10OD026922-01

Impact of volatile compounds contained within smoke on retronasal aroma of wildfire affected wines

Jenna A. Fryer[1] and Elizabeth Tomasino[2*]

[1]Provost Fellow, [2]Associate Professor, Department of Food Science and Technology, Oregon State University, 3051 SW Campus Way, Corvallis, OR, 97331

[*]Corresponding Author: elizabeth.tomasino@oregonstate.edu, 541-737-4866

As the occurrence of wildfires is increasing, smoke has become a growing concern to the wine industry. Smoke carries volatile compounds which can be absorbed by grapes and are present in the resulting wine. These compounds impart uncharacteristic, and unpleasant, smoky, burnt, and dirty aromas with a lingering ashy finish. Current markers of smoke exposure in grapes are the predominant volatile phenols known to be present in smoke. These phenols, however, when added to unaffected wines in the concentration found in affected wines are unable to recreate the smoke sensory experience. This indicates the impact of other compounds within smoke on the sensorial alterations to these wines. The goals of this work are to evaluate the flavor alterations introduced by different families of volatiles to wines. Using napping with ultra-flash profiling along with descriptive analysis, two varietals of wine (Syrah, Grenache) with two different levels of smoke exposure (High, Low) were evaluated. Low smoke exposed wines were treated with volatile additions to determine what was able to bring the flavor profile to similarity with the high smoke exposed wine. It is hypothesized that a combination of the volatile phenols along with novel volatiles will be able to recreate the flavor experience of smoke-exposed wine. Additionally, the use of fining agents based on the volatiles will be able to reduce the sensorial impact of high levels of smoke exposure. Through this work, there will be a better understanding of the volatile compounds that are most indicative of the sensorial experience of these wines. This will help guide industry on what markers should be targeted along with how best to approach mitigation of these defects as wildfire occurrence continues.

Funding Support: USDA – Agricultural Research Service (ARS) #2072-21000-570-00D and NIH #1S10OD026922-01

Film coatings as a protective layer in reducing grape absorption of smoke phenols

Lindsay Garcia[1,7], Trung Tran[1,7], Jooyeoun Jung[2,7], Joseph DeShields[3,8], D. Cole Cerrato[2,7], Michael Penner[4,7], Alexander Levin[5,8], Yanyun Zhao[6,7], and Elizabeth Tomasino[4,7*]

[1]Graduate Research Assistant, [2]Assistant Professor Senior Research Associate, [3]Faculty Research Assistant, [4]Associate Professor, [5]Associate Professor and Director, [6]Associate Dean, [7]Department of Food Science and Technology, Oregon State University, 3051 SW Campus Way, Corvallis, OR, 97331; [8]Department of Horticulture, Southern Oregon Research and Extension, 569 Hanley Rd, Central Point, OR, 97502

*Corresponding Author: elizabeth.tomasino@oregonstate.edu, 541-737-4866

Wine grapes exposed to wildfire smoke have resulted in wines with burnt and ashy sensory characteristics, resulting in loss of product. Currently there are no effective solutions in the market to prevent the uptake of smoke compounds into grapes. In this study, innovative film coatings were developed to prevent smoke phenols from entering Pinot noir grapes. Four different film types were developed using cellulose nanofibers as the coating forming matrix. The formulations were developed by incorporating different quantities of chitosan and/or β-cyclodextrin into the matrix. The coatings effectiveness in reducing smoke phenols were investigated. Film coatings were applied at veraison at both in a vineyard in Southern Oregon, where two smoke events occurred in the 2022 vintage. At harvest, half of the grapes were washed to remove the films. This was to determine if smoke phenols are blocked or bind to the film coatings. Further analysis of the interaction of smoke phenols with film coatings was done by observing any volatile phenol diffusion through the film using a custom-made polytetrafluoroethylene apparatus. Smoke phenols in grape juice were analyzed using GCMS and smoke glycosides using LCMS. Results show that some of the film coatings were effective and reducing the amount of smoke compounds that were able to absorb into the grapes.

Impact of malolactic fermentation timing and the use of non-*Saccharomyces* yeast during cold soaking on Pinot noir wine color and sensory properties

Matt Garcia[1], Elizabeth Tomasino[2], James Osborne[3*]

[1]Graduate Research Assistant, [2]Associate Professor, and [3]Professor, Department of Food Science and Technology, Oregon State University, 3051 SW Campus Way, Corvallis, OR, 97331

*Corresponding Author: james.osborne@oregonstate.edu, 541-737-6494

Malolactic fermentation (MLF) is an integral step in red wine production. While traditionally conducted after alcoholic fermentation, MLF can occur concurrently with alcoholic fermentation by inoculating with *Oenococcus oeni* soon after the initiation of alcoholic fermentation.
Although a concurrent fermentation reduces the overall time required to ferment, there are concerns about excessive acetic acid production, color loss, and competition with *Saccharomyces cerevisiae.* If concurrent fermentations are to become more widely used, a better understanding of this winemaking technique is necessary. This study investigated the effect of MLF timing on Pinot noir wine chemical and sensory properties. The use of a non- *Saccharomyces* yeast during cold soaking was also studied due to potential interactions with *O. oeni* and production of acetaldehyde, a key compound in formation of stable color compounds. Six non-*Saccharomyces* cultures were assessed for acetaldehyde production under cold soak conditions in a model grape juice. *T. delbrueckii* Alpha produced the highest concentration of acetaldehyde (71.8 mg/L) and was selected for use in Pinot noir winemaking experiments. Pinot noir wines were produced with and without cold soaking, with and without *T. delbrueckii* Alpha, and with a concurrent or sequential MLF. Only minor differences in the time to completion of alcoholic fermentation or MLF were observed between the treatments suggesting that the concurrent MLF did not impact the performance of the alcoholic fermentation. Acetaldehyde concentrations changed throughout wine production. At the end of cold soak, the treatments inoculated with *T. delbrueckii* Alpha contained significantly more acetaldehyde (21.5 mg/L) compared to the uninoculated counterparts (3.4 mg/L). Further, these treatments also had the highest acetaldehyde concentrations during alcoholic fermentation. Acetaldehyde rapidly decreased after *O. oeni* inoculation whether conducted concurrently or sequentially. The significance of these changes in acetaldehyde on color will be determined once wines are assessed for various color parameters including anthocyanins and polymeric pigments.

Funding Sources: Oregon Wine Board, American Vineyard Foundation

Effect of Thiols and Esters on Tropical Fruit Perception, Preference, and Emotional Response in Chardonnay Wine

Chase J. Lucas[1], Amanda Dupas De Matos[2], and Elizabeth Tomasino[3*]

[1]Graduate Research Assistant, [3]Professor, Department of Food Science and Technology, Oregon State University, 100 Weigand Hall, 3051 SW Campus Way, Corvallis, OR 97331.
[2]Sensory Research Officer, Food Experience and Sensory Testing Lab, Massey University, Private Bag 11222, Palmerston North, Wanganui-Manawatu, NZ

*Corresponding Author: Elizabeth.Tomasino@oregonstate.edu, 541-737-4866

Tropical fruit aromas in wines are prominent in wines like Sauvignon Blanc, one of the top produced white wines in the United States. These tropical aromas are due to the presence of volatile thiols and esters. These volatile compounds are present in Chardonnay grapes and previous work showed fermentation temperature gradients and time on skins result in an increase in thiol and ester compounds post fermentation. The purpose of this work is to determine if winemaking practices could alter the ester and thiol concentrations in Chardonnay wines and how those chemical differences influenced wine consumers preferences and emotional responses. Four treatments were tested at varying fermentation temperature gradients and skin contact times: control fermentation at 13°C with no skin contact (SC0FG0), fermentation at 13°C with 18 hours of skin contact (SC1FG0), fermentation temperature gradient by time (20°C for 4 days then reduced to 13°C) with no skin contact (SC0FG1), fermentation temperature gradient by time with 18 hours of skin contact (SC1FG1). Liking, using a 7-point Likert scale, showed there was not a significant difference between treatments. Emotional response, using a 5-point Rate-All-That-Apply (RATA), showed significant differences for calm and disgusted emotions. Check-all-that-apply (CATA) for aroma descriptors showed that SC0FG0 is described using aromas of passionfruit, lychee, and pome fruit, SC1FG0 had aromas of grapefruit and floral, SC0FG1 was described as having melon, lychee, and pineapple aromas, and SC1FG1 was described with aromas of lemon/lime, mango, and guava. Understanding how tropical aromas are perceived by the consumer can allow winemakers to produce tropical fruit aroma Chardonnay wines consistently year to year.

Funding: American Vineyard Foundation, #2021-2479

Effect of fermentation temperature gradient and skin contact on ester and thiol production and tropical fruit perception in Chardonnay wines

Chase J. Lucas[1], Angelica Iobbi[1], and Elizabeth Tomasino[2]

[1]Graduate Research Assistant, [2]Professor, Department of Food Science and Technology, Oregon State University, 100 Weigand Hall, 3051 SW Campus Way, Corvallis, OR 97331.

*Corresponding Author: Elizabeth.Tomasino@oregonstate.edu, 541-737-4866

Wines with tropical fruit aromas have become increasingly more available. With increased availability of different wine styles, it has become important to understand the compounds that cause the fruity aromas in wine. Previous work using micro fermentations showed that fermentation temperature gradients and time on skins resulted in an increase in thiol and ester compounds post fermentation and these compounds are known to cause tropical fruit aroma in wines. This work aimed to scale up these fermentations/operations to determine if the desired aromas could still be achieved and if there is a perceivable difference in tropical fruit aromas, liking, and emotional response in the wines at the consumer level. Four treatments were tested at varying fermentation temperature gradients and skin contact times: control fermentation at 13°C with no skin contact (SC0FG0), fermentation at 13°C with 18 hours of skin contact (SC1FG0), fermentation temperature gradient by time (20°C for 4 days then reduced to 13°C) with no skin contact (SC0FG1), fermentation temperature gradient by time with 18 hours of skin contact (SC1FG1). A change in winemaking scale did not alter the pH, residual sugar, or alcohol of the wines. Chemical analysis and descriptive sensory analysis were conducted to determine the alterations on the composition and aroma profiles of these wines. Check-all-that-apply (CATA) showed different prominent aromas for each wine treatment, with pome fruit, stone fruit, pineapple, honeysuckle, honey, and passionfruit being the most perceived aromas. Descriptive analysis (DA) showed that SC1FG0 was significantly different from both SC0FG1 and SC1FG1. SC1FG0 presented the most tropical fruit aromas, SC1FG1 presented more stone fruit, and SC0FG1 presented more honey and lemon/lime. Understanding the causes of tropical fruit aromas in wine and processes that alter these compounds is necessary to ensure winemakers can achieved tropical fruit quality consistently.

Funding: American Vineyard Foundation, #2021-2479

SERS-Based Raman Spectroscopy for Quick Smoke Exposure Analysis

Alec B. Sobotka[1], Yanping L. Qian[2], Chong Fang[3], and Michael C. Qian[6*]

Graduate Research Assistant[1], Department of Food Science and Technology, Oregon State University, Wiegand Hall, 3051 SW Campus Way, Corvallis, OR 97331, Research Assistant Professor/Senior Researcher[2], Department of Crop and Soil Sci., Oregon State University, Wiegand Hall, 3051 SW Campus Way, Corvallis, OR 97331, Professor of Chemistry[3], Department of Chemistry, Oregon State University, Linus Pauling Science Center, 2900 SW Campus Way, Corvallis, OR 97331, Professor of Chemistry[4], Department of Chemistry, University of Portland, Swindells Hall, 5000 N. Willamette Blvd., Portland, OR 97203, President and CEO[5], Spectra Scientific, Portland, OR 97229, Professor of Flavor Chemistry[6], Department of Food Science and Technology, Oregon State University, Wiegand Hall, 3051 SW Campus Way, Corvallis, OR 97331

[*]Corresponding Author: michael.qian@oregonstate.edu, 541-737-9114

The presence of smoke taint in wine grapes has become a major concern for the United States Wine industry due to the smoky, ashy, and medicinal characteristics of off-aromas. When the grapes are exposed to heavy smoke, the volatile phenols will be absorbed by the grapes and subsequently bind to the sugars present. When the grapes are fermented, the phenols are released from their bonded glycosides, contaminating the produced wine. The most common smoke-exposure-related volatile phenols in wine grapes are guaiacol, 4-methylguaiacol, m-cresol, o-cresol, and p-cresol. These phenols are typically analyzed in free and total forms using GC-MS, giving us information on smoke exposure and potential smoke taints. Due to the costly and time-consuming nature of GC-MS, we strove to find a more efficient method for rapid detection limits of smoke exposure using Raman spectroscopy and SERS-based substrates. Smoke-exposed Pinot noir wine samples were analyzed by GC-MS for free and total volatile phenols. Raman spectra were obtained with a 1064 nm laser, but results were inconclusive due to the high amount of noise produced on the wine spectra. Silver Nanoparticles (AgNPs) of different sizes were synthesized by creating and using a seed solution in volumes ranging between 100-200 µl. Surface-enhanced Raman spectra (SERS) with the nanoparticles were obtained using the 1064 laser. Still, intense fluorescence and frontline scattering due to the presence of AgNPs complicated the obtained spectra. Tests using a 785 nm Raman laser have shown promise in reducing the noise in the spectra. Further tests and analysis will be run using the 785 nm laser to obtain the wine spectra. Machine learning will be employed to correlate spectra with volatile phenol data obtained by GC-MS.

Funding: American Vineyard Foundation (AVF) and Oregon Wine Board (OWB)

Optimal irrigation initiation time based on grape and wine composition and quality

Tingting Ye [1], Alexander Levin [2], Yanping L Qian[3], and Michael Qian[4*]

[1]Graduate Research Assistant, Department of Food Science and Technology, Oregon State University, 100 Wiegand Hall, Corvallis OR 97331, [2]Associate Professor, Department of Horticulture, Oregon State University, 4017 Agriculture and Life Sciences Building, Corvallis, OR 97331, [3]Associate Professor, and [4]Professor, Department of Food Science and Technology, Oregon State University, 100 Wiegand Hall, Corvallis OR 97331.

*Corresponding Author: michael.qian@oregonstate.edu, 541-737-9114

The influence of irrigation initiation timing on grape composition and volatile compounds of wine was investigated in three sub-regions of the Rogue Valley. Grapevines irrigated at 70% evapotranspiration (ET_c) standard were conducted with different irrigation initiation timing based on normalized vine water status thresholds (ΔSWP) throughout berry development. The grape yield and total soluble solid contents were improved with late irrigation initiation time, but there was not obvious change in pH and titratable acidity. Volatile compounds in wine were analyzed by headspace-solid phase microextraction-gas chromatography-mass spectrometry (headspace-SPME-GC-MS). The concentrations of most esters increased in wines in response to late irrigation initiation, especially ethyl propionate, ethyl, 2-methylbutanoate, ethyl hexanoate and ethyl succinate. The concentrations of ethyl butanoate and ethyl octanoate were highest when ΔSWP = 0.8 Mpa. However, the concentrations of isobutyl acetate, isoamyl acetate, hexyl acetate, phenethyl acetate and ethyl cinnamate decreased when irrigation initiation timing delayed. Besides, concentrations of ethyl acetate and ethyl lactate increased with late initial irrigation but decreased when initial irrigation continued to be delayed. The concentrations and of volatile compounds in wines showed different trends in different regions. Overall, late initiation irrigation increased the calculated Odor Activity Value (OAV), except ΔSWP at 1 MPa, suggesting possible more fruity wines.

Funding: The financial support provided by USDA-ARS-Northwest Small Fruit Research.

Polyphenols from Grape Pomace as Reactive Carbon to Improve Agriculture Sustainability through Mediation of Soil Microbial Population

Shijie Zhang [1] and Yanping L Qian[2*]

[1]Graduate Research Assistant, Department of Crop and Soil Science, Oregon State University, 109 Crop Science Building, Corvallis OR 97331, [2]Associate Professor (Sr. Res.), Department of Crop and Soil Science, Oregon State University, 109 Crop Science Building, Corvallis OR 97331

*Corresponding Author: yan.ping.qian@oregonstate.edu, 541-737-1135

Phenolics are highly reactive compounds often known as “reactive carbon”. They can enter soil systems, mediate microbial populations in soil, and improve soil health. In addition, studies have shown the addition of phenolics to soil could enhance crop yield and quality. According to the Oregon Department of Agriculture report, 105,586 metric tons of wine grapes were produced in 2019 in Oregon. As a result, many tons of wine pomace are generated each year, rich in bioactive phenolic compounds. This study investigated various technologies to extract polyphenols from Pinot noir pomace with green chemistry. The phenolics can be extracted with 50m*M* sodium acetate buffer (pH=5.0) at 45^{o}C, and the pomace /buffer ratio of 2:20 with 4 hours of extraction had the highest yield (21mg gallic acid equivalent/g dry mass). No significant difference between the overnight (20hrs) and 4 hrs extraction for the total phenol content (TPC). The extract contained over 60% of tannins estimated by the Folin–Ciocalteu analysis. Cellulase and tannase assisted (1%, enzyme/sample) extraction yielded a similar TPC to the control (no enzyme), while pectinase showed a slightly higher TPC. Other six varieties of grape pomaces will be tested, including Chardonnay, Cabernet Sauvignon, Pinot, Merlot, Syrah, and Petite Syrah.

Funding: Agricultural Research Foundation

Evaluating the economic trade-offs of mitigation options when Red Blotch infects vineyards

Matthew Ramsell[1] and James A. Sterns[2*]

[1]Undergraduate Scholar, 2023 URSA Engage Program, Oregon State University, 618 Kerr Administration Bldg, Corvallis, OR 97331; [2]Associate Professor, Department of Applied Economics, Oregon State University, 213 Ballard Extension Hall, Corvallis, OR 97331.

*Corresponding author: jasterns@oregonstate.edu, 541-737-1406

Grape Red Blotch Virus (GRBV) is a viral disease which has reached endemic levels in all major wine-grape growing regions of Oregon. In infected vineyards, GRBV has been shown in some cases to reduce quality and delay yield of wine grapes, both of which have negative economic impacts for vineyard owners. In other cases, Red Blotch may have very late in the season onset or even be asymptotic, which complicates decisions about how to respond once infection is confirmed. Vineyard managers have limited and less than ideal options to mitigate Red Blotch once it is detected in a vineyard, and each option has its own set of economic costs. Four of these options are considered - vineyard removal and re-establishment; manage with more intensive input usage; maintain vineyard practices but anticipate delayed harvests and the associated risks and costs thereof; and, maintain vineyard practices but anticipate shift to selling grapes as rosé wine grapes at a price discount. This poster summarizes a comparative economic analysis of these four options. This analysis is based upon "representative" vineyard data and results only are intended to provide base reference points for vineyard managers contemplating their options to respond to an GRBV outbreak in a vineyard.

Funding: URSA Engage Program, Office of Academic Affairs, Oregon State University.

Efficacy of biological fungicides regimes and an intelligent sprayer on management of grape powdery mildew

Brent Warneke[1], Lloyd Nackley[2], Jay Pscheidt[3*]

[1]Faculty Research Assistant, Department of Horticulture, 4575 SW Research Way, Corvallis, OR 97333, [2]Assistant Professor, Nursery Production, North Willamette Research and Extension Center, 40816 NE Miley Rd., Aurora, OR 97002, [3]Extension Plant Pathology Specialist, Department of Botany and Plant Pathology, 4575 SW Research Way, Corvallis, OR 97333

Corresponding Author: jay.pscheidt@oregonstate.edu, 541-737-5539

In 2022 micronized sulfur and biological fungicides were applied during critical periods for grape powdery mildew (GPM) management on Pinot noir and Pinot gris vines, and in tank mixes on Chardonnay vines at the Botany and Plant Pathology Field Laboratory in Corvallis, Oregon. In the past, use of biological products all season long resulted in poor powdery mildew control while use of sulfur alone can result in good GPM control. Combinations of biological and sulfur products were tested to determine if using biologically-based products with sulfur could improve GPM management over sulfur alone. In Pinot noir and Pinot gris blocks, biological fungicides were applied from the beginning of the spraying season up until 50% bloom, then micronized sulfur was applied from bloom until berry touch, then biological fungicides were applied until veraison. In those trials, AUDPCs and cluster severities among treated vines were around 2000, and from 74.7%-85.8% and 67.8%-79.8%, respectively. For the tank mix trial, a low (less than 3 lb/A) rate of sulfur has been observed to result in poor GPM control, though it is significantly better than no treatment at all. The Chardonnay trial involved tank mixes of below-label-rate micronized sulfur (2lb/A) and biological fungicides applied for the duration of the season. In the Chardonnay tank mix trial, AUDPCs among treated vines ranged from 1558-1781, while all cluster severities were around 85% except for the Theia tank mix which was 54.1%. Some biological fungicides tested were able to augment control of GPM over their respective controls. Use of an intelligent sprayer to apply biological fungicides resulted in lower application rates and may need adjustment to apply more material per acre. The magnitude of control that can be expected when applying a biological fungicide is heavily dependent on the disease pressure of a given vineyard and/or season.

Funding: Integration of Intelligent Spray Technology into IPM Programs in Specialty Crop Production (USDA-ARS Project Number 58-5082-2-010).

Global Diversity and Epidemiology of the Crown Gall Pathogen *Agrobacterium vitis*

Alexandra J. Weisberg[1]*, Melodie Putnam[2], Andrea M. Schiffer[3], and Jewell M. Jung[3]

[1]Assistant Professor, [2]Senior Instructor II and Director of the OSU Plant Clinic, and [3]Undergraduate Research Assistant, Department of Botany and plant Pathology, Oregon State University, 2701 SW Campus Way, Corvallis, OR 97331
*Corresponding Author: Alexandra.Weisberg@oregonstate.edu, 541-737-7003

Crown gall is a major disease of grapevine and results in millions of dollars in damages each year to nurseries and vineyards. It is a particular problem in cold climates and for grapevine grown on rootstock. Crown gall of grape is typically caused by the bacterial pathogen *Agrobacterium vitis.* Understanding the process by which *A. vitis* spreads, both within and between growers and vineyards, is important for understanding how to prevent disease. Comparative analysis of whole genome sequencing data provides the highest resolution for epidemiology and can be used to characterize transmission patterns and identify pathogen reservoirs. However, relatively few strains of *A. vitis* have been sequenced to date. The genetic diversity of this pathogen is also unknown. We are collecting *A. vitis* strains from around the world, including strains isolated from grapevine crown gall samples from across the Pacific Northwest. Using whole genome sequencing, we are uncovering the global diversity of this important pathogen and are developing a framework for genomic epidemiology of crown gall disease. This framework will be used to provide a high resolution characterization of pathogen transmission and inform on the spread of disease.

Funding: This work was funded in part by startup funds from the Department of Botany and Plant Pathology to AJW.

Thank you for being a part of the

Oregon Wine Research Institute

Grape Day!

Oregon State University
Oregon Wine
Research Institute

4017 Agricultural and Life Sciences Building
Corvallis, Oregon 97331

owri.oregonstate.edu