2018 Grape Day

Business and Economics from Vineyard to Wine Sales
LaSells Stewart Center, OSU Campus, April 3

Abstracts of Presentations and Posters

Program Schedule

8:30 AM – 9:00 AM	Registration and Refreshments
9:00 AM – 9:05 AM	Introduction and Welcome; *Mark Chien, Program Coordinator*
9:05 AM – 9:50 AM	**A Step Towards More Sustainable Vine Health: The Clean Plant Approach to Grape Virus Disease Management** *Dr. Neil McRoberts, Associate Professor of Plant Pathology, UC Davis*
10:00 AM – 10:45 AM	**Using Economic Analysis to Inform Business Decisions- Examples for the Oregon Wine Industry** *Dr. Catherine Durham, Associate Professor, Department of Applied Economics, OSU*
10:45 AM – 11:45 AM	**Interactive Poster Session** This session will provide you the opportunity to interact one-on-one with scientists and students conducting research at the OWRI. Posters will feature research findings that are in-progress for various research projects being conducted across a wide array of topics within viticulture, enology, and economics.
11:45 AM – 12:30 PM	**Valuing Oregon's Wine Growing Regions** *Dr. Robin Cross, Assistant Professor and Senior Researcher, Department of Applied Economics, OSU*
12:30 PM – 1:30 PM	**Lunch**
1:30 PM – 2:15 PM	**Are Vineyard Buyers Warming Up to Cooler Locations? Quantifying the Value of Location Specific Adaptability** *Jason Beasley, Graduate Student, Department of Applied Economics, OSU*
2:15 PM – 2:45 PM	**Break/Poster Session**
2:45 PM – 3:30 PM	**Benefits of Early Adoption of Preventative Pruning Practices in Managing Grapevine Trunk Diseases** *Dr. Jonathan D. Kaplan, Professor, Dept. of Economics,*
3:30 PM – 3:45 PM	Final Q&A and program wrap-up

Re-evaluating Field Methods of Water Status Determination in the Vineyard

Alexander Levin[1]*, Rebecca Lake[2], Tannar Williams[3]

[1]Assistant Professor, Southern Oregon Research and Extension Center, Oregon State University, Central Point OR; [2]Student Technical Assistant, Department of Horticulture, Oregon State University, Corvallis OR; [3]Student Technical Assistant, Department of Chemical Engineering, Stanford University, Stanford CA

*Corresponding Author: alexander.levin@oregonstate.edu, 541-772-5165

The pressure chamber is a widely used tool for assessing water potential (Ψ) in plants and is commonly used as a tool in vineyard irrigation scheduling. Although it is regarded as the most robust method for assessment of plant water status in the field, there continues to be disagreement among users about proper technique for both midday leaf (Ψ_{leaf}) and midday stem (Ψ_{stem}) water potential determination. To resolve these discrepancies, three experiments were performed in order to understand how varied techniques affect either Ψ_{leaf} and Ψ_{stem} values: (1) Ψ_{leaf} response to time interval between sample excision and pressurization (2) Ψ_{leaf} response to sample preparation method (e.g. petiole re-cutting) prior to pressurization; and (3) Ψ_{stem} response to sample equilibration time. All experiments were performed by two operators using the same instrument. There were no significant effects of time interval or operator on Ψ_{leaf} at time intervals from 15 to 60 s. Few significant differences were found in Ψ_{leaf} among sample preparation methods (experiment 2), and they depended on operator. Ψ_{stem} varied 5% when samples were allowed to equilibrate from 10 to 240 minutes (min) prior to determination. The results show that time intervals of up to 60 s between excision and pressurization are acceptable for accurate data, and petiole re-cutting does not substantively affect Ψ_{leaf} determination. Additionally, Ψ_{stem} equilibration times can be as short as 10 min. However, significant differences were observed between operators across all three experiments. Thus, the technical skill of the operator during pressurization may play a larger role in the outcome of the determination relative to the preparation of the sample prior to pressurization.

Post-Veraison Water Deficits Improve Pinot Noir Fruit Quality Without a Yield Penalty

Alexander Levin[1]*, Christopher Jenkins[2], Judy Chiginsky[3]

[1]Assistant Professor, Southern Oregon Research and Extension Center, Oregon State University, Central Point OR; [2]Faculty Research Assistant, Southern Oregon Research and Extension Center, Oregon State University, Central Point OR; [3]Biological Sciences Research Technician II, Southern Oregon Research and Extension Center, Oregon State University, Central Point OR

*Corresponding Author: alexander.levin@oregonstate.edu, 541-772-5165

Despite increasing Pinot noir acreage in warmer and more arid growing regions, cultivar-specific drought responses remain poorly elucidated in the literature. A multi-year field experiment was established with eight irrigation treatments designed to alter vine water status either pre- or post-veraison. Irrigation was scheduled based on applying water at fractions of estimated crop evapotranspiration (ET_c) ranging from 25 to 100%. Vine water status was monitored with regular measurements of midday stem water potential (Ψ_{stem}) throughout the growing season. At harvest, fruit were analyzed for yield and quality characteristics. The treatments significantly altered vine water status both pre- and post-veraison, giving rise to four levels of water stress at both times. Berry size was negatively correlated with water deficits at both times. Berry primary metabolism (Brix, pH, and TA) was less responsive to water deficits relative to secondary metabolism (polyphenolics). Total anthocyanins increased with water deficits both pre- and post-veraison, and the response was more sensitive pre-veraison, but the differences were not significant across treatments. In contrast, tannins and iron-reactive phenolics (IRPs) in skins and seeds were significantly impacted by the treatments. Skin tannins and IRPs increased with pre-veraison water deficits, but decreased with post-veraison water deficits. Seed tannins and IRPs increased with pre-veraison water deficits, but were not affected by post-veraison water deficits. In general, berry secondary metabolism was more sensitive to pre-veraison water deficits. However, post-veraison water deficits resulted in higher concentrations of secondary metabolites overall. While wine sensory analyses have yet to be completed, the results suggest that post-veraison water deficits may be more effective at improving Pinot noir fruit quality without a yield penalty compared to pre-veraison deficits.

Developing a Model System to Identify Main Mechanisms Involved in Nitrogen Growth Responses of Grafted Grapevines

Landry Rossdeutsch[1*], R. Paul Schreiner[2], Patricia A. Skinkis[3], Joseph Orton[4], Laurent Deluc[5]

[1]Post-Doctoral Research Associate, Department of Horticulture, Oregon State University, Corvallis OR; [2]Research Plant Physiologist, USDA-ARS-HCRU, Corvallis OR; [3]Associate Professor & Viticulture Extension Specialist, Department of Horticulture, Oregon State University, Corvallis OR; [4]Undergraduate Research Assistant, Department of Horticulture, Oregon State University, Corvallis OR; [5]Associate Professor, Department of Horticulture, Oregon State University, Corvallis OR

*Corresponding Author: landry.rossdeutsch@oregonstate.edu, 541-737-2982

The scion growth potential (vigor) in grafted grapevines results from the three-way interaction between environment, scion genotype, and rootstock genotype. Since nitrogen (N) availability is a major driver of grapevine growth, understanding N regulation in scion and rootstock will lead to new insights to control canopy size in vineyards. We are developing a model system to study N regulation by evaluating the N supply responses of 12 scion-rootstock combinations with known differences in scion and rootstock vigor. Our primary objectives are to understand the influence of scions and rootstocks on growth parameters and resource allocation, and to evaluate the role of N uptake regulation in scion growth response. To address the first objective, we measured components of vine water relations and gas exchange, plant biomass, carbon (C), and N allocation in four plants tissues (leaves, stem, trunk and roots). Preliminary results supported the expected vigor behavior of the three Pinot noir scions used in this experiment, but this was not true for the four rootstocks examined. Nitrogen availability altered C and N allocation in all tissues, but scion vigor was not affected. It seems that the N requirement for 1-year old vines was satisfied by our lowest N rate, and the experiment will be repeated under greater N limitation. However, this first trial will allow us to study the role of C and N reserves on scion vigor during the second growing season. We are addressing the second objective by comparing N uptake and N transport among two rootstocks using $_{15}NO_3$. Several experiments are underway to compare N uptake kinetics over a range of N concentrations and N transport rate in response to plant N status. These analyses will be complemented with gene expression studies targeting the transport and signaling of N in roots and leaves.

Performance of Taxonomically Diverse Arbuscular Mycorrhizal Fungi Isolated from a Red-Hill Soil in Symbiosis with Pinot Noir

R. Paul Schreiner[1]*, David P. Janos[2], Tian Tian[3]

[1]Research Plant Physiologist, USDA-ARS-HCRU, Corvallis OR; [2]Professor (retired), University of Miami, Coral Gables FL; [3]Graduate Research Assistant, Department of Horticulture, Oregon State University, Corvallis OR

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

Grapevines rely on arbuscular mycorrhizal fungi (AMF) to obtain ample phosphorus (P) from soils with moderate to low P like the red-hill soils in western Oregon. Prior research using DNA sequencing indicated that 6-11 species of AMF colonized the roots of Pinot noir within a given vineyard. However, little is known about how different species of AMF function in vineyard ecosystems. We investigated the effectiveness of five native AMF species representing five genera to promote growth and nutrient uptake of Pinot noir in a red-hill soil under well-watered and droughted conditions. Rooted cuttings were grown in the presence of five different AMF or without AMF, and with or without moderate drought stress. After 8 and 16 weeks whole vines were destructively harvested and biomass and nutrient uptake were determined. Results showed that four of the five AMF colonized roots well, increased root and shoot biomass, and predominantly increased P uptake. However, the *Claroideoglomus* isolate was superior in promoting shoot growth and P movement to shoots. The ability to enhance vine growth and P uptake was not related to the extent of arbuscules in roots suggesting that some P exchange may occur via hyphae inside roots. Potassium and iron uptake were enhanced also by the four effective isolates. Water limitation reduced P uptake in this soil as a main effect across all AMF treatments, indicating that water stress reduces the capacity for P uptake by all the AMF species studied here in a similar manner. These findings suggest that AMF within *Claroideoglomus* would be the best choice for inoculating young grapevines to maximize establishment in low P soils.

Comparing Nitrogen Addition in the Vineyard versus in the Winery on Pinot Noir and Chardonnay

Tian Tian[1], R. Paul Schreiner[2*], Patricia A. Skinkis[3], James Osborne[4], Elizabeth Tomasino[5]

[1] Graduate Research Assistant, Department of Horticulture, Oregon State University, Corvallis OR; [2]Research Plant Physiologist, USDA-ARS-HCRU, Corvallis OR; [3] Associate Professor & Viticulture Extension Specialist, Department of Horticulture, Oregon State University, Corvallis OR; [4] Associate Professor & Enology Extension Specialist, Department of Food Science & Technology, Oregon State University, Corvallis OR; [5] Assistant Professor, Department of Food Science & Technology, Oregon State University, Corvallis OR

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

The impact of nitrogen (N) additions in the vineyard on vine productivity and wine characteristics as compared to winery N additions on the latter is being evaluated in Pinot noir (PN) and Chardonnay (CH). Five treatments, including no vineyard or winery N addition (Control), addition of diammonium phosphate in the winery (+DAP), addition of organic-N in the winery (+Org N), addition of N in the vineyard to the soil (+Soil N) or to the foliage (+Foliar N) were established with four replicates for each variety. The +Foliar N treatment began in 2017, while the other four treatments were evaluated in 2016 and 2017 for CH. For PN, all five treatments began in 2017. In both varieties, +Soil N application increased leaf N status and fruit yeast assimilable nitrogen (YAN) levels, but did not alter yield, leaf area, or vine water status in the first year. Foliar N application also increased fruit YAN in the first year without increasing leaf N or vine growth. Vine growth and yield increased in CH in response to +Soil N in the second year along with leaf and fruit N status. Root colonization by arbuscular mycorrhizal fungi (AMF) was reduced in both varieties in the +Soil N vines with greater effect in CH where N was applied for two years. Vine P status decreased also in CH in the second year in concert with lower AMF. Winery N additions boosted must YAN levels to roughly match those of the +Soil N and +Foliar N musts. Must fermentation in CH proceeded more rapidly where N was added in the vineyard or the winery, while fermentation in PN was increased only by vineyard N addition. Sensory evaluation of 2016 CH wines showed that +Soil N wines differed from wines of Control, +DAP, and +Org N.

Understanding the Impact of Dormant Pruning Method on Pinot Noir Bud Fruitfulness and Yield

Miranda R. Ulmer[1], Patricia A. Skinkis[2*]

[1]Graduate Research Assistant; [2]Associate Professor & Viticulture Extension Specialist, Department of Horticulture, Oregon State University, Corvallis OR

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

Oregon 'Pinot noir' producers primarily use cane pruning, as they believe spur pruning results in severely reduced yields due to a lack of fruitful basal buds. However, spur pruning provides an opportunity to partially mechanize pruning operations, thereby increasing vineyard labor efficiency. A two-year study was initiated in a commercial vineyard to determine the viability of spur pruning 'Pinot noir' in Oregon. Bud fruitfulness, a measure of the potential fruitfulness of the vine and a major component of yield, was measured on cane and spur pruned vines during January 2017 and 2018. Canopy growth, yield predictors and harvest yield data were measured throughout the growing season on cane and spur pruned vines. The results show spur-pruned vines have fruitful basal buds. During 2017, bud fruitfulness was similar at all node positions in cane and spur pruned vines except for node three where spur pruned vines had higher bud fruitfulness. In 2018, cane-pruned vines had greater bud fruitfulness than spur-pruned vines at node five. In the early spring there were 5 more inflorescence per vine on cane-pruned vines. Inflorescences of cane-pruned vines had more florets and berries post-fruit set than spur pruned vines, but the percent of florets turned to berries (fruit set) did not differ between the two pruning methods. At harvest, spur-pruned vines had more clusters per vine whereas cane-pruned vines had 27% heavier clusters, but there was no difference in whole vine yield. Basic fruit ripeness at harvest did not differ between the two pruning methods. A relationship was evident between vine vigor and bud fruitfulness parameters. In 2017, larger inflorescence primordia of the primary bud were observed with larger internode diameter. In 2018, higher bud fruitfulness was observed with greater cane weights. This work will continue into the 2018 growing season and winter of 2019.

Role of Auxin-Response Factor 4 (VitviARF4) in the Timing of Ripening Initiation in *Vitis vinifera*

Satyanarayana Gouthu[1], Victor M. Puoci[2], Grace Cheng[3], Laurent G. Deluc[4*]

[1]Post-Doctoral Research Associate, Department of Horticulture, Oregon State University, Corvallis OR; [2]Undergraduate Research Assistant, Department of Biophysics and Biochemistry, Oregon State University, Corvallis OR; [3]Undergraduate Research Assistant, Department of Microbiology, Oregon State University, Corvallis OR; [4*]Associate Professor, Department of Horticulture, Oregon State University, Corvallis OR

*Corresponding Author: laurent.deluc@oregonstate.edu, 541-737-4356

The timing of the ripening initiation is an important trait for wine grape production. The research project aims to validate the regulatory function of ARF4 in the timing of ripening initiation. The objectives are to: 1) characterize its role by inducing or silencing the gene expression in the microvine system and to identify its interacting protein partners during the ripening process, 2) to identify ripening-related genes targeted by ARF4, and 3) to evaluate fruit composition of berries, where the timing of ripening-initiation is altered. Towards this goal, we established the microvines at OSU and optimized different steps of producing embryogenic calli through anther culture, inoculation of calli with agrobacterium harboring the genes of interest, production of transformed embryos, transitioning of these embryos to plantlets, and finally the transfer of the plantlets in the green house. We conducted our first trial experiments to engineer the biosynthesis of abscisic acid (hormone that promotes ripening) using this pipeline and we were successful in obtaining the transformed embryos. Currently, the cloning of the different plasmid constructs aimed to induce and silence ARF4 in the microvines has been performed. Towards identifying the protein partners of ARF4, we found 170 potential candidates using protein-protein interaction screening assays. They include proteins involved in ABA signaling (VitViPAPA1), sugar sensing (VitviHXK1), and ethylene signaling (VitviETR4), all of which are known to influence fruit ripening. Finally, we adapted and tested a new analytical method on grape berry extracts to measure metabolites associated with organic acids, amino acids, phenolics, carbohydrates, polyols, and three classes of flavonoids (anthocyanins, flavonols, monomer and dimer of tannins).

The Effect of Yeast Assimilable Nitrogen on SO_2 Production by *Saccharomyces cerevisiae* During Wine Fermentation

María Alessandri[1], Alan Bakalinsky[2*]

[1]Graduate Research Assistant, Department of Food Science & Technology, Oregon State University, Corvallis OR; [2]Associate Professor, Department of Food Science & Technology, Oregon State University, Corvallis OR

*Corresponding Author: alan.bakalinsky@oregonstate.edu, 541-737-6510

Sulfur dioxide is commonly used during winemaking as an antimicrobial agent and antioxidant. However, high concentrations can lead to problematic fermentations and prevent the malolactic fermentation from occurring. Apart from the sulfur dioxide additions made by winemakers, naturally-occurring sulfites can be produced by yeast as a normal byproduct of metabolism. Previous studies have found that production varies among strains and is affected by fermentation conditions. In some cases, production appears to be high enough to replace or significantly reduce sulfite additions by winemakers. This could be particularly relevant for organic winemaking, where sulfites additions are disallowed by USDA regulations but are permitted in the EU. We have found that nitrogen availability in grape must is one source of variability. It has been previously reported that nitrogen content in grape must has an effect on yeast sulfur metabolism, but until now the focus has been largely on H_2S production. To our knowledge, a systematic study of the effect of nitrogen on sulfite production has not been undertaken. Here, we analyzed sulfite production by different yeast strains as a function of available nitrogen. Our results indicate that higher levels of nitrogen correlate with higher sulfite production and that the form of the nitrogen has a major impact. Also, our results show that commercial nitrogen supplements do not affect sulfite production in a consistent manner. This information should be of use for winemakers interested in producing high quality organic wines.

Impact of Pre-Fermentation Cold Soak Conditions on Pinot Noir Wine Aroma Compounds

Mengying Fu[1], Jared Johnson[2], James Osborne[3], Michael Qian[4*]

[1]Graduate Research Assistant, Department of Food Science & Technology, Oregon State University, Corvallis OR; [2]Graduate Research Assistant, Department of Food Science & Technology, Oregon State University, Corvallis OR; [3]Associate Professor & Enology Extension Specialist, Department of Food Science & Technology, Oregon State University, Corvallis OR; [4]Professor, Department of Food Science & Technology, Oregon State University, Corvallis OR

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

This study investigated how pre-fermentation cold soak conditions impacted Pinot noir wine aroma. In 2016, Pinot noir wines were produced from grapes that were cold soaked for six days at two different temperatures (6 or 10°C) with the addition of 0, 50, or 100 mg/L SO_2. Six non-*Saccharomyces* yeast species, commonly isolated from grapes, were added at the start of cold soak and their populations monitored. Wine was also produced from grapes that did not undergo cold soak. At the end of cold soak there were significant differences in a number of volatile compounds. Higher concentrations of ethyl acetate and isoamyl acetate were present in cold soaks conducted at 10°C compared to 6°C, while higher concentrations of phenyl ethyl acetate were present in cold soaks conducted at 10°C with 100 mg/L SO_2. Significant differences were also found in the volatile aromas of the finished wines, particularly esters. In the second year of the study an addition of *Metschnikowia fructicola* was made at the beginning of a six day cold soak. At the end of cold soak, treatments with *M. fructicola* contained significantly higher alcohols and less acetate esters. In the finished wines there were significant differences in volatile aromas between wines made from grapes that did or did not undergo a cold soak. Pinot noir wines produced without cold soak had significantly higher ethyl esters such as ethyl butyrate, ethyl isobutyrate, and ethyl octonoate. Wines made with *M. fructicola* also contained significantly higher concentrations of beta-citronellol, as compared to the no cold soak treatment.

The Use of Signal Detection Theory (d') in Food Sensory Analysis

Rachel Hahn[1*], Elizabeth Tomasino[2], Claudio Fuentes[3]

[1]FacultyResearch Assistant, Department of Food Science & Technology, Oregon State University, Corvallis OR; [2]Assistant Professor, Department of Food Science & Technology, Oregon State University, Corvallis OR; [3]Associate Professor, Department of Statistics, Oregon State University, Corvallis OR

*Corresponding Author: hahnra@oregonstate.edu, 503-880-2616

Signal detection theory (often denoted by the sensitivity index d` value) uses differences in means to quantify the difference between a stimulus of interest and a possible random distracting pattern, usually in the form of a “Correct Rejection” or “False Alarm” application. The use of signal detection theory originates in psychology, where subjects were used to determine a “threshold” of fatigue after extensive exposure to various stimuli. The development of this threshold coined the concept of “signal to noise” for data collected by unreliable subjects (such as humans or animals). The term “signal to noise” is used to describe the ratio of usable data to “noise” or irrelevant data, and is a form of threshold analysis. This threshold analysis helps determine how human subjects are impacted during qualitative data collection sessions.

Initially the sensitivity index was developed by psychologists, but has since been applied to the food industry - specifically to sensory science. For many reasons, the sensitivity index has become an industry standard for analyzing food sensory data because it measures and estimates fatigue in food sensory subjects. However, there is little literature revisiting the assumptions of the sensitivity index in the context of food sensory science. This research aims to revisit the sensitivity index’s mathematical expression and assumptions in order to tailor it to food sensory research.

Investigating Fruitiness Aroma Perception in White Wines

Angelica de Castro Iobbi[1], Chase Jutzi[2], Elizabeth Tomasino[3*]

[1]Doctoral Candidate, [2]Undergraduate Research Assistant, [3]Assistant Professor, Department of Food Science & Technology, Oregon State University, Corvallis OR

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

Wine aroma is complex and there are many different compounds that can be responsible for various aromas. White wine aroma is characterized by impact compounds such as volatile thiols and those that produce aromas due to interactions with other wine components. In this study we investigated the aroma chemical component interactions influencing fruitiness perception of white wines. A neutral Oregon Pinot gris wine was produced and aroma was removed by the addition 1g/L Lichrolut®EN. A combination of compounds was added to the wine, forming the aroma base. These aroma base compounds are present in all wines. Treatments investigated a range of different chemical compounds such as esters, terpenes, alcohols, and thiols. Treatment aroma compounds were added to the base wine at different concentrations and combinations. Over several sensory sessions trained panelists evaluated the different fruity aromas of the treatment wines. Panelist performance was determined using REML and canonical variate analysis was used to relate the wine chemical composition to sensory perception. Results show a relationships between terpenes and stone fruit aromas, and volatile thiols and tropical fruit aromas. Other aroma compounds in combination with terpenes were found to alter the type of fruity aromas. The results of this work will help develop wine styles and understand white wine quality.

Effects of Crop Level on Pinot Noir Wine Composition

Jingwen Li[1], Patricia A. Skinkis[2], Michael Qian[3*]

[1] Graduate Research Assistant, Department of Food Science & Technology, Oregon State University, Corvallis OR; [2]Associate Professor & Viticulture Extension Specialist, Department of Horticulture, Oregon State University, Oregon Wine Research Institute, Corvallis OR; [3]Professor, Department of Food Science & Technology, Oregon State University, Oregon Wine Research Institute, Corvallis OR

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

To determine the impacts of crop level on wine quality, a cluster thinning experiment was conducted in more than 10 vineyards over a 3-year period (2013 – 2015). Crop level were reduced by cluster thinning using a cluster per shoot regime (2, 1.5 and 1 cluster/shoot) and compared to a full crop control (non-thinned). One site used variable ton per acre treatments (3.25, 3, 2.5, 2, 1.75 ton/acre). After harvest, fruit from field replicates were combined to produce one wine for each treatment. Those wines were analyzed for volatile composition by GC-MS and GC-FID in triplicate. The relationships between crop level and concentration of quality-important compounds in wine were determined by regression analysis. Results showed that crop thinning practice affected some volatile compositions in different years. Crop thinning level decreased the content of middle-chain acids (C6-C10) in 2013 vintage. However, it increased the content of esters, terpinoids, alcohols and middle-chain acids in 2014 vintage. Moreover, crop thinning level have limited impact on volatile compositions in 2015 vintage. From 2013 to 2015 vintage, the content of volatile compositions in wine increased. Combining all three years' data without considering year difference, it was found that the content of esters had increasing trends while terpinoids, alcohols, middle-chain acids and volatile phenolic compounds had no difference with higher crop thinning level.

Use of non-*Saccharomyces* Yeast to Reduce Volatile Acidity Production During Cold Soaking of Pinot Noir Grapes

Jared Johnson[1], Mengying Fu[2], Michael Qian[3], James Osborne[4]*

[1]Graduate Research Assistant; [2]Graduate Research Assistant; [3]Professor, Department of Food Science & Technology, Oregon State University, Oregon Wine Research Institute, Corvallis OR; [4]Associate Professor, Department of Food Science & Technology, Oregon State University, Oregon Wine Research Institute, Corvallis OR

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

Cold soaking is a technique used during red winemaking to alter the aroma, flavor, and phenolic content of a wine. However, cold soaking does not come without risk as this process can result in the production of spoilage compounds such as acetic acid and ethyl acetate if excessive growth of microorganisms such as *Hanseniaspora uvarum* (*Kloeckera apiculata*) occurs. *H. uvarum* growth during cold soak is typically controlled through the use of sulfur dioxide and maintaining grapes at a cold temperature. While effective, these methods can also restrict the growth of other non-*Saccharomyces* yeast present during cold soak that can contribute positively to wine aroma. Recently, the addition of select non-*Saccharomyces* yeast at the beginning of cold soak has been suggested as an alternative method for reducing volatile acidity. This study investigated the efficacy of select non-*Saccharomyces* yeast strains for the reduction of volatile acidity and *H. uvarum* growth during cold soak. Commercial non-*Saccharomyces* yeasts were screened for their ability to reduce *H. uvarum* growth and acetic acid production during a simulated cold soak in a grape juice based medium. *H. uvarum* growth and acetic acid production was reduced in the presence of all non-*Saccharomyces* yeast tested with some yeast reducing *H. uvarum* growth and acetic acid production to a greater extent. One yeast, *Metschnikowia fructicola*, was then used in Pinot noir winemaking experiments. Pinot noir grapes were inoculated with a combination of *H. uvarum* and *M. fructicola* and cold soaked for six days. During cold soak *M. fructicola* reduced *H. uvarum* growth and significantly decreased acetic acid and ethyl acetate production. These results suggest that the addition of non-*Saccharomyces* yeast during cold soak may be an effective method for reducing the production of volatile acidity by *H. uvarum*.

Influences of Yeast Product Addition and Fermentation Temperature on Changes in Lipid Compositions of Pinot Noir Wines

Quynh Phan[1], James Osborne[2], Elizabeth Tomasino[3*]

[1]Doctoral Candidate; [2]AssociateProfessor; [3]Assistant Professor, Department of Food Science & Technology, Oregon State University, Corvallis OR

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

Concentration and composition of lipids present in wine have been shown to be dependent on yeast and grape variety. There are two sources of lipids in wine: firm tissues of grapes and alcoholic fermentation by yeast. The temperature of a wine fermentation also affects lipid metabolism; therefore, lipid profiles vary under different winemaking processes. This study investigated how different types and amount of yeast derivative products added would affect the lipid content of Pinot noir wines. Changes in lipid composition in wines according to fermentation temperature were also examined. The 2017 Oregon Pinot Noir grapes were fermented at 8 °C and 27 °C. After primary and malolactic fermentation, yeast products Autolees and Oenolees (Laffort, USA) were added to the wines for 60 days as separate treatments of Autolees (0.3 g/L, 0.175 g/L, and 0.05 g/L) and Oenolees (0.4 g/L, 0.3 g/L, and 0.2 g/L) or as a mixture of Autolees (0.3 g/L) and Oenelees (0.4 g/L). Liquid-liquid extraction method with chloroform/methanol (2:1 v/v) as the solvent was used to extract total lipids in the experimental wines. The lipids extracted were classified as polar lipids (PL), sterols (ST), free fatty acids (FFA), triglycerides (TG), and cholesterol ester (CE) by thin-layer chromatography. The fatty acids derivatives, fatty acid methyl esters (FAME), were analyzed by gas chromatography mass spectrometry (GCMS). The results of this study contribute to the understanding of how differences in lipid composition could be useful for determining wine style and wine quality. Fatty acid composition and the polyunsaturated fatty acid (PUFA) ratio n-6/n-3 could be used to evaluate the quality of lipids in wine. In future research, it would substantially contribute to the investigation of the interactions of lipids with other wine components such as tannin and polysaccharide affecting the sensory properties of wine such as taste and mouthfeel.

Comparative Analyses of the Total Carbohydrate Composition of Red Wine Polysaccharides

Ludwig Ring[1], Elizabeth Tomasino[2], James Osborne[3], Michael Qian[4]*

[1]Research Associate; [2]Assistant Professor; [3]Associate Professor and Enology Extension Specialist; [4]Professor, Department of Food Science & Technology, Oregon State University, Oregon Wine Research Institute, Corvallis OR

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

The chemical nature of red wine mouthfeel has been addressed in multiple recent studies. However, their vast majority focused on polyphenols such as tannins, which have been shown to account for the astringency of red wine. In contrast, the compounds contributing to mouthfulness and body remain unclear. This ongoing study investigates red wine polysaccharides, since they might affect the textural sensation and thus the mouthfeel properties of red wine. A procedure including precipitation, hydrolysis, and derivatization (silylation with TMSI) has been developed to analyze the total carbohydrate composition by means of their per-*O*-trimethylsilylated methyl glycoside derivatives via GC-FID. Variations in the total carbohydrate composition of several red wines could be observed. Although all samples comprised the same monomers (mannose, arabinose, galactose, rhamnose, galacturonic acid, glucose, and xylose), the ratios differed. Depending on the monomer, this can give insights into the winemaking process. For instance, a high mannose portion could result from a longer yeast contact, since mannoproteins originate from yeast cell walls. However, it remains to be investigated which parameters most influence the composition (e.g. winemaking process, grape variety, age), and to which extent this affects the mouthfeel. Additional sensory studies will examine the organoleptic impact of the red wine polymers to elucidate potential correlations between analytical and sensory data, in order to get a better understanding of the non-volatile sensory active compounds in red wine.

Field Observations of *Tortistilus* Species Associated with Oregon Vineyards

Daniel T. Dalton[1*], Richard J. Hilton[2], Vaughn M. Walton[3]

[1]Graduate Research Assistant, Department of Horticulture, Oregon State University, Corvallis OR; [2]Senior Faculty Research Assistant, Southern Oregon Research & Extension Center, Oregon State University, Central Point OR; [3]Professor, Department of Horticulture, Oregon State University, Corvallis OR

*Corresponding Author: daniel.dalton@oregonstate.edu, 541-737-3913

Field collections of candidate insect vector species of *Grapevine red blotch virus* (GRBV) were acquired in Oregon in 2017, and biological attributes of these species were documented. Treehopper insects (Hemiptera: Membracidae) of a previously confirmed vector species, *Spissistilus festinus*, were found near vineyards in southern Oregon. Two morphospecies of the treehopper genus *Tortistilus* were found in and around Willamette Valley and southern Oregon vineyards where virus spread was observed. *Tortistilus* species overwinter as eggs that are laid in new stems or behind the buds of woody perennial plants including oak, apple, pear, hawthorn, and grapevine. Eggs hatch in spring, and early instars fall from woody hosts onto lush herbaceous understory plants such as vetch. Late-instar insects migrate to drought-hardy plant species including wild carrot as the understory vegetation dries out in early summer. Fifth instar insects molt into adults beginning in July. Eggs are deposited into woody hosts to complete the insect life cycle. Adult insects do not appear to migrate great distances but are found along vineyard edges and in unmanaged habitats in summer and fall.

A combination of collection techniques including vacuum sampling, sweep netting, sticky trap monitoring, visual surveying, and hand sampling was used to determine the insect life cycle and behavioral patterns. Feeding by treehoppers may girdle young, growing stem tissues. In red-fruited winegrape cultivars, extreme reddening of tissue above girdled areas is usually apparent, allowing growers to find insects and track potentially affected plants.

Tested insects showed persistence of GRBV for at least five weeks following acquisition of the virus in greenhouse transmission trials. Actual transmission of GRBV by *Tortistilus* species remains to be confirmed in greenhouse bioassays.

Deficit Irrigation and Grapevine Red Blotch Disease Management

A. N. KC[1*], A. L. Rasmussen[2], A. Levin[3]

[1]Assistant Professor, Southern Oregon Research and Extension Center, Oregon State University, Central Point OR; [2]Faculty Research Assistant, Southern Oregon Research and Extension Center, Oregon State University, Central Point OR; [3]Assistant Professor, Southern Oregon Research and Extension Center, Oregon State University, Central Point OR

[*]Corresponding Author: achala.kc@oregonstate.edu, 541-772-5165

Grapevine Red Blotch Disease (GRBD) is a newly identified disease of grapevines caused by grapevine red blotch virus (GRBV). The economic loss associated with the disease is reduction in fruit quality and delayed ripening. The imposition of moderate water deficits is a common viticultural practice to advance ripening and improve fruit quality. However, the stress experienced by vines under deficit irrigation can potentially amplify the negative effects of GRBD. Research was conducted to understand interaction between GRBV and deficit irrigation on disease development and fruit quality. A split-plot field experiment with two irrigation treatments, wet and dry; and two vine statuses, healthy and infected, were arranged in a randomized complete block design. Irrigation treatments were imposed by varying the number of drip emitters per vine where wet and dry treatments were irrigated at 100 and 66% of crop evapotranspiration (ETc) respectively. Inline water meters were used to quantify applied water amounts. Vine health status was determined by PCR-based assays as infected or non-infected with GRBV. Disease severity was recorded every week after the first symptom appearance on infected vines. No significant interaction between water and vine health status to disease severity was observed. However, the stem water potential of infected vines was significantly higher compared to healthy vines in both dry and wet treatments. In addition, overall fruit quality of the infected vines was better in wet irrigation treatment than the dry treatment. The results suggest that keeping vines well-watered may mitigate some of the negative effects of GRBV infection.

Interaction of Deficit Irrigation and Grapevine Red Blotch Virus (GRBV) on Disease Development and Grapevine Physiology

Alexander Levin[1]*, Christopher Jenkins[2], Judy Chiginsky[3], Ann Rasmussen[4], Achala KC[5]

[1]Assistant Professor, Southern Oregon Research and Extension Center, Oregon State University, Central Point OR; [2]Faculty Research Assistant, Southern Oregon Research and Extension Center, Oregon State University, Central Point OR; [3]Biological Sciences Research Technician II, Southern Oregon Research and Extension Center, Oregon State University, Central Point OR; [4]Faculty Research Assistant, Department of Botany and Plant Pathology, Oregon State University, Corvallis OR; [5]Assistant Professor, Southern Oregon Research and Extension Center, Oregon State University, Central Point OR

*Corresponding Author: alexander.levin@oregonstate.edu, 541-772-5165

While moderate water deficits advance ripening and improve fruit quality in healthy grapevines, they can potentially amplify negative effects of viral disease in GRBV-infected grapevines. Therefore, a field experiment with two irrigation treatments – wet and dry – and two disease statuses – healthy (RB-) and infected (RB+) – was initiated to understand the interaction between GRBV infection and deficit irrigation. Wet vines were irrigated at 100% of crop evapotranspiration (ET_c), while dry vines received water at 66% ET_c. Healthy and infected vines were confirmed by PCR-based assays. Disease progression and severity were recorded weekly after first symptoms were observed on RB+ vines, and vine water status (Ψ_{stem}) was regularly monitored throughout the growing season. At harvest, yield and yield components were determined, and berry samples were collected for compositional analyses. There was no significant interaction between irrigation treatment and disease status on disease progression and severity. Pre-veraison Ψ_{stem} was not affected by disease status but was significantly higher in RB+ vines post-veraison. The higher Ψ_{stem} in RB+ vines resulted in larger berries and yield at harvest, but few of the differences in yield and yield components among treatments were significant. Berry flavonoids were more strongly affected by disease status compared to sugars and acids, with little effect of irrigation treatments. In skins and seeds, significant differences among treatments were observed in concentration and content of anthocyanins and iron-reactive phenolics (IRPs), but not tannins. Small differences in tannins coupled with large differences in IRPs suggests that GRBV strongly inhibited biosynthesis of non-tannin IRPs, particularly in seeds. Taken together, these results suggest that keeping vines well-watered may mitigate some of the negative effects of GRBV, but ultimate changes in secondary metabolism due to GRBV infection may necessitate using infected fruit for different wine programs or blending with lots from healthy vineyards.

Exogenous Application of Abscisic Acid (s-ABA) Does Not Improve Fruit Composition in Red Blotch-Infected Grapevines

Vaughn Walton[1], Alexander Levin[2]*, Daniel Dalton[3], Christopher Jenkins[4], Judy Chiginsky[5], Achala KC[6], Ann Rasmussen[7]

[1]Professor, Department of Horticulture, Oregon State University, Corvallis OR; [2]Assistant Professor, Southern Oregon Research and Extension Center, Oregon State University, Central Point OR; [3]Graduate Research Assistant, Department of Horticulture, Oregon State University, Corvallis OR; [4]Faculty Research Assistant, Southern Oregon Research and Extension Center, Oregon State University, Central Point OR; [5]Biological Sciences Research Technician II, Southern Oregon Research and Extension Center, Oregon State University, Central Point OR; [6]Assistant Professor, Southern Oregon Research and Extension Center, Oregon State University, Central Point OR; [7]Faculty Research Assistant, Department of Botany and Plant Pathology, Oregon State University, Corvallis OR

*Corresponding Author: alexander.levin@oregonstate.edu, 541-772-5165

Plant growth regulators are commonly used to improve ripening and berry composition in healthy grapevines. Recently, it has been suggested that grapevine red blotch virus (GRBV) disrupts the normal hormonal signaling involved in ripening onset in berries. Since endogenously produced abscisic acid (s-ABA) plays a large role in berry ripening, it is possible that exogenous applications of s-ABA could mitigate the deleterious effects of GRBV. Therefore, the effects of exogenous s-ABA application on fruit ripening in GRBV-infected grapevines were tested in two Oregon AVAs characterized by different climates: the Willamette Valley (WV; cool and wet) and the Rogue Valley (RV; warm and dry). At each site, candidate vines were identified based on the previous year's symptomology data and confirmed for GRBV infection with PCR-based assays. Cluster-directed spray applications of s-ABA were made at 50% veraison and 10-14 days later at a rate of 300 mg/L. Experimental treatments were a 2x2 factorial combination of disease condition – healthy (RB-) and infected (RB+) – and s-ABA application – spray (ABA+) or no spray (ABA-). At harvest, here were no significant effects of s-ABA on berry fresh weight, total soluble solids (TSS), pH, or titratable acidity within RB+ or RB- vines. There were also no significant effects of disease status on the aforementioned parameters in WV vines, and in RV vines, only TSS was significantly higher in RB- vines. There were no significant interactions between s-ABA application and disease status with respect to polyphenolic composition in skins and seeds. Surprisingly, ABA+ vines had lower concentrations of tannins and iron-reactive phenolics across either disease status in the skins, but since there were minimal effects in the seeds, there were non-significant treatment effects with respect to total concentration. Overall, the exogenous application of s-ABA at veraison did not improve fruit composition across two distinct growing regions at harvest.

Exploring the Symptomology and Impacts of Red Blotch Disease on Pinot Noir

Justin Litwin[1], Patricia A. Skinkis[2*], Robert Martin[3]

[1]Undergraduate Research Assistant, Department of Horticulture, Oregon State University, Corvallis OR; [2*]Associate Professor & Viticulture Extension Specialist, Department of Horticulture, Oregon State University, Corvallis OR; [3]Research Plant Pathologist, USDA-ARS, Corvallis OR

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

In 2012 a new virus, Grapevine Red Blotch associated Virus (GRBaV), was identified in grapevines and has the potential to reduce fruit quality. To determine the effect of the virus in Oregon's Willamette Valley, a study was conducted to monitor and document visual symptoms of GRBaV in cool climate Pinot noir and identify the impacts on vine physiology and fruit quality. A commercial Pinot noir vineyard in the Eola-Amity Hills AVA was monitored from pea-size stage of berry development through leaf fall in 2017. Vines were monitored based on their virus status (positive or negative) and symptoms (present or asymptomatic). Visual observations of symptoms and chlorophyll measures were made weekly and photoassimilation and stomatal conductance were taken when weather conditions allowed. Visual symptoms in the canopy did not occur until after 100% veraison and began with basal leaf reddening then progressed apically as the season continued. Leaf fall occurred later in vines that showed virus symptoms. All vines with canopy symptoms also tested positive for GRBaV, but not all vines that tested positive showed symptoms. This could indicate a delayed symptomatic expression of the virus. The chlorophyll measures taken through the season showed no difference between symptomatic and asymptomatic vines. GRBaV positive vines had lower stomatal conductance and photoassimilation in general but was only statistically significant during two dates. Nutrient samples collected during veraison showed only lower leaf phosphorus in GRBaV positive vines, while symptomatic vines had lower potassium and lower petiole Ca, Mg, Zn, and Mn. Yield and basic ripeness did not differ at harvest. Virus status did not affect berry concentrations of total anthocyanin, tannin and phenolics. However, symptomatic vines had lower total phenolic concentrations. The same vines are to be monitored in 2018 to gain a further understanding of the physiological impacts of the disease.

Rapid Sampling Techniques to Determine QoI Fungicide Resistance in *Erysiphe necator*

Sarah R. Lowder[1*], Tara Neill[2], Michelle M. Moyer[3], Timothy D. Miles[4], Walter F. Mahaffee[5]
[1]Graduate Research Assistant, Department of Botany and Plant Pathology, Oregon State University, Corvallis OR; [2]Biological Science Technician, USDA-ARS-HCRU, Corvallis OR; [3]Associate Professor & Statewide Viticulture Extension, Washington State University, Prosser WA; [4]Assistant Professor, Department of Plant, Soil and Microbial Sciences, Michigan State University, East Lansing MI; [5]Research Plant Pathologist, USDA-ARS-HCRU, Corvallis OR

*Corresponding Author: lowders@oregonstate.edu, 704-574-4285

Control failures of grape powdery mildew (caused by *Erysiphe necator*) after the use of quinone outside inhibitor (QoI; FRAC 11) fungicides have been reported throughout OR, WA, and CA. Quick, cost-effective methods to detect fungicide resistance in *E. necator* are necessary to reduce the selection for resistant isolates and mitigate ineffective fungicide applications. In 2017, *E. necator* samples were collected via linear stratified sampling techniques by placing a ToughSpot adhesive dot directly onto a mildew colony (n=119) or by wiping gloves with sterile cotton swabs (n=65) after simulated canopy management. A competitive TaqMan qPCR assay, previously demonstrated to be in 100% agreement with fungicide resistance screening bioassays, was used to detect the G143A mutation in the *cytb* gene that is associated with QoI resistance. Both methods detect similar distributions in resistance status: ToughSpots- 48.7% resistant, 43.7% sensitive, 7.6% mixed; Swabs- 59.2% resistant, 24.5% sensitive, 16.3% mixed. This indicates that either method could be a viable rapid sampling technique with minimal interruption to production schedules. A rapid sampling technique for chasmothecia (syn. cleistothecia) overwintering in grape bark is being developed to provide managers with a pre-season assessment of the risk of fungicide resistance for the growing season following sampling. The wild-type and resistant genotypes can be determined from a single chasmothecium in a background of 0.2 g of dry bark. Reducing the time and costs required to assess fungicide resistance will allow vineyard managers to make informed choices when determining fungicide product selection and rotation.

Clean Grapevines – Toward a Harmonized Grapevine Certification Program for the Pacific Northwest

Robert R. Martin[1*], Research Leader and Research Plant Pathologist, USDA-ARS-HCRU, Corvallis OR

*Corresponding Author: bob.martin@ars.usda.gov, 541-738-4041

More than 70 virus and virus-like agents are known to infect grapevines worldwide and relatively few are of major importance in the Pacific Northwest. This is due in a large part to quarantine and certification programs that have resulted in elimination of most of these viruses from planting materials. Once identified, Grapevine Red Blotch Virus (GRBV) was added to the list of pathogens in most certification programs. Certification programs are managed by State Departments of Agriculture and therefore each state may have different requirements that nurseries need to meet to produce 'certified grapevines'. Thus, certification can mean different things depending on where the plants were produced. Over the past two years there has been an effort to harmonize the grapevine certification programs and quarantines in Washington, Oregon and Idaho. This effort is funded by a grant from USDA-APHIS and led by Vicky Scharlau, Executive Director - Washington Wine Industry Foundation. The project includes regulatory staff from the three State Departments of Agriculture, industry members, nurseries and scientists. The process is near completion and there should be a common grapevine certification program for the Pacific Northwest in the near future. There are several caveats that growers need to be aware of: 1. The new certification program will require all grapevines coming into the three states be from certification programs recognized by the State Department of Agriculture; 2. Certification is voluntary and therefore not all nurseries are selling certified grapevines; 3. The harmonized certification programs do not require that grapevines sold in-state are from certified nurseries; and 4. For grafted grapevines the rootstock and scion must be certified for the plant to be considered certified, for example, certified rootstock brought into the state and grafted with uncertified scion wood does not result in a certified plant.

A Regional Mildew Management Problem - Fungicide Resistance in the West

Tara Neill[1*], Sarah R. Lowder[2], Timothy D. Miles[3], Walt Mahaffee[4], Michelle Moyer[5], Monica Cooper[6]

[1]Biological Science Technician, USDA-ARS-HCRU, Corvallis OR; [2]Graduate Research Assistant, Department of Botany and Plant Pathology, Oregon State University, Corvallis OR; [3]Assistant Professor, Department of Plant, Soil and Microbial Sciences, Michigan State University, East Lansing MI; [4]Research Plant Pathologist, USDA-ARS-HCRU, Corvallis OR; [5]Associate Professor & Statewide Viticulture Extension, Washington State University, Prosser WA; [6]Farm Adviser-Viticulture, University of California Cooperative Extension, Napa CA

*Corresponding Author: tara.neill@ars.usda.gov, 541-738-4028

Throughout 2017, a field scouting campaign that covered Central and Northern California, Western Oregon, and Southern Washington yielded over 850 field samples and 64 isolates of *Erysiphe necator.* Analysis of these samples for resistance to quinone outside inhibitor (QoI) fungicides (FRAC Group 11) using the G143A qPCR assay indicated widespread resistance throughout all grape growing regions scouted (93% contained resistant *E. necator* among ToughSpot kit samples); with higher frequencies in Washington (96%) and California (93%) than in Oregon (47%). Analysis of 2017 *E. necator* single-chain isolates generated similar results with 90% of Washington, 94% of California, and 69% of Oregon isolates showing QoI resistance. These results were confirmed when isolate and field sample DNA underwent genotyping by sequencing analysis of the *cytb* gene. These results are similar to the QoI resistance observed throughout Oregon in 2015 and 2016. Analysis of air samples collected using impaction spore samplers from commercial vineyards from 2013-2017 showed that QoI resistance was detected 2 years prior to control failures in 2015 and the frequency of the G143A allele peaked in 2016 and decreased in 2017. Air samples collected from Washington vineyards during the 2017 growing season showed a very high frequency of the G143A allele with 93% of samples containing it. Analysis of these samples and isolates using various molecular techniques and fungicide resistance bioassays to determine resistance to demethylation inhibitor (DMI) fungicides (FRAC group 3) and succinate dehydrogenase inhibitor (SDHI) fungicides (FRAC group 7) is ongoing. A qPCR assay was developed to target a point mutation (Y136F) of the CYP51 gene that is a contributing factor to DMI resistance in *E. necator*; the mutation is present in 85% of tested 2017 isolates (n=60) and 96% of 2015 and 2016 isolates (n=92).

Early Bloom Timing for Better Grape Powdery Mildew Management in Western Oregon

Jay W. Pscheidt[1*], John Bassinette[2]

[1]Professor; [2]Faculty Research Assistant, Department of Botany and Plant Pathology, Oregon State University, Corvallis OR

*Corresponding Author: pscheidj@science.oregonstate.edu, 541-737-5539

Fungicides efficacy trials for grape powdery mildew (*Erysiphe necator*) management have been conducted at the Botany and Plant Pathology Field Laboratory, Corvallis, OR since 1990. Vineyards, with any of five cultivars, were cane or spur pruned with vertical shoot positioning and managed for weeds and insects. Weather conditions were favorable each year for intense powdery mildew development. Fungicides were applied using a hooded boom sprayer where each spray program was replicated on four or five sets of five vines each. Fungicide programs were initiated when the first powdery mildew symptoms were observed and then continued at two week intervals through the season. The incidence and severity of powdery mildew on fruit was evaluated visually at veraison by arbitrarily selecting 50 clusters for examination from the middle three vines of each replicate. Data from 31 fungicide trials conducted between 1990 and 2017 were used for analysis. The fungicide program with the lowest powdery mildew severity in each trial was selected for comparison with other trials. Programs selected consisted of either a single formulation (containing one or two FRAC groups) used throughout the season or multiple formulations (each containing one or two FRAC groups) alternated throughout the season. All fungicide programs were initiated prior to bloom for each cultivar. At two week intervals, bloom applications occurred anywhere from 10% (BBCH 61) to 90% bloom (BBCH 69) with two programs missing bloom altogether. In general, incidence or severity of powdery mildew was lower if season-long programs included an application at 10% to 40% bloom. Incidence or severity of powdery mildew tended to be higher and with greater variation if season long programs included an application at later bloom stages. Growers in western Oregon are advised to adjust fungicide management programs to include an application at early bloom stages.

A Step Towards More Sustainable Vine Health: the Clean Plant Approach to Grape Virus Disease Management

Neil McRoberts[1*], Kamyar Aram[2], Kari Arnold[3], Deborah Golino[4]

[1]Associate Professor, Plant Pathology Department, University of California, Davis CA; Post Doctoral Researcher, Plant Pathology Department, University of California, Davis CA; [3]Farm Adviser, University of California Cooperative Extension, Modesto CA; [4]Cooperative Extension Specialist, Director, Foundation Plant Services, University of California, Davis CA

*Corresponding author: nmcroberts@ucdavis.edu 530-752-3248

Many things chip away at the productivity and profitability of grape vines, and since the bulk of the economic production from wine grapes typically comes after 10 years post-planting, it is important to prolong the healthy life span of vines well into their second or third decade. Many grape viruses are known, causing a range of diseases that vary in severity in the context of wine production. Over the last two decades Grape Leaf Roll associated Virus 3 (GLRaV-3) and Grape Red Blotch Virus (GRBV), have been of particular concern in California, and the source of considerable anxiety about the value and operation of the grape certification system. In 2011 we started a research and extension effort to understand the dynamics of vectored viruses in grape production systems in California and to provide information to growers, nurseries and winemakers, on how to improve the voluntary grape certification and regulation scheme. The grape production quality chain is characterized by several pressure points where trust and cooperation among participants is key to achieving long-term, sustainable success. The talk will outline what those pressure points are, why they matter, and what steps grape growers can take to manage them in cooperation with other actors in the quality chain. The key message is that there is no zero-cost, simple solution. Given that, the best way to invest time and money is in starting the life of a vineyard with the cleanest planting material possible, and then cooperating with other growers in neighborhoods to manage viruses and their vectors down to as low as level as possible. Virus disease management built around a long-term cooperative strategy is susceptible to all the well-known reasons that cooperation-dependent activities might fail; knowing what the best approach is, does not necessarily make it easy to adopt.

Are Vineyard Buyers Warming Up to Cooler Locations? Quantifying the Value of Location Specific Adaptability

W. Jason Beasley[1*], Robin Cross[2]

[1]Graduate Research Assistant; [2]Assistant Professor and Senior Researcher, Department of Applied Economics, Oregon State University, Corvallis OR

*Corresponding Author: beasleyw@oregonstate.edu, 541-737-2942

It is commonly accepted that a vineyard's local climate is an important attribute for grape quality. Even though vineyards may persist for decades, there is great uncertainty in the exact change in climate expected for any given location. Instead, prospective vineyard owners must evaluate current climates and assume future suitability in any location. What might influence the perception surrounding the uncertainty in anticipated climate changes? We will show that one perception shifter is the media. Coverage of climate change from well-known print news outlets will affect beliefs pertaining to climate change. If the media does shift perception as we will show, to what extent do our beliefs influence our real-time decisions? We use a newly compiled data set, comprised of vineyard attributes and sales information for much of Oregon and California. We combine this data with measures of media coverage on climate change and survey results pertaining to the importance of climate change. Results suggest that greater media coverage of climate change is strong enough to influence values in cooler regions. That is, vineyards that are cooler than average in California and the entire state of Oregon, have a premium that increases with the strength of perceptions on climate change. These results may suggest that adaptation to climate change is already occurring. This also suggests that media coverage may influence the timing of a northern migration of capital, as all of Oregon vineyards command a cooler premium. Additionally, we explore how large these premiums may be across regions and how future forecasts influence pricing.

Valuing Oregon's Wine Growing Regions

Robin M. Cross[1]*

[1]Assistant Professor and Senior Researcher, Department of Applied Economics, Oregon State University, Corvallis OR

*Corresponding Author: robin.cross@oregonstate.edu, 541-737-1397

Vineyard owners can now receive a tax break in proportion to the reputation (brand) value of their winegrowing region. The IRS requires evidence for the deduction, leading to the question: Who decides reputation's value?

Reputation is a collection of contributions from grape growers, winemakers, expert reviewers, and consumers, together with a region's geography, climate, and soil. Even the federal government plays a role by granting American Viticultural Area (AVA) status to regions demonstrating distinctive geo-climatic characteristics.

Appraisers and statisticians have tried to separate and value these interrelated contributions across many of the world's greatest wine producing regions. But, interrelatedness confounds both human and statistical methods, lowering confidence and depressing reported values.

Fortunately, French mathematician Laplace proposed a solution to the interrelatedness problem in 1816, shortly after Legendre's introduction of the most enduring statistical model - linear regression. We derive the solution's statistical properties and use it to revisit past research on Oregon's vineyard values. We explore how interrelatedness disrupted previous findings, lowered estimates, and limited the breadth of testable questions. We then separate and analyze the influences of geo-climatic characteristics, federal recognition, and the evolution of reputation over time.

Using economic analysis to Inform Business Decisions – Examples for the Oregon Wine Industry

Catherine Durham[1], James Sterns[2*]

[1]Associate Professor, Department of Applied Economics, Food Innovation Center, Oregon State University, Portland OR; [2]Associate Professor, Department of Applied Economics, Oregon State University, Corvallis OR

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

Within the past 15 months, the Oregon Wine Research Institute (OWRI) has taken steps to establish "economic and business research" as a priority commitment on par with the OWRI's historic support for viticulture and enological research. Early initiatives included a state-wide listening tour to gather industry perspectives about priority research topics related to the business and economics of the wine industry. Based upon findings from this tour, two research programs related to consumer demand and purchasing behavior are being implemented. As resources have become available, other issues of importance to the industry have been added to the research docket. Our goal for this presentation is to provide an overview of the general nature and potential scope of these research activities and the underlying motivation to include economic research to OWRI's overall commitment to the Oregon wine industry.

As a first step, we will provide an overview of the research approaches and typical scope of research questions addressed by applied economists. Our goal is to develop a shared understanding of the potential contributions of this new research program. Economic research can be an excellent complement to the long-standing efforts of OWRI research and outreach faculty. This work can also be designed to build up and extend market-oriented research that historically has been provided by the Oregon Wine Board.

We will conclude our presentation with highlights of research findings to date from our study of wine club best practices and club member preferences. As we will detail, we began this two-phased project by contacting over 500 wineries in OR, asking for their cooperation in distributing an internet-based questionnaire to their wine club members. We received 75 responses from OR wineries and a summary of their responses will be presented along with details about the second phase of the project - a survey of wine club members.

Benefits of Early Adoption of Preventative Pruning Practices in Managing Grapevine Trunk Diseases

Jonathan D. Kaplan[1*], Renaud Travadon[2], Monica Cooper[3], Vicken Hillis[4], Mark Lubell[5], Kendra Baumgartner[6]

[1]Professor, Department of Economics, Sacramento State University, Sacramento CA; [2]Assistant Project Scientist, Department of Plant Pathology, University of California, Davis CA; [3]Viticulture Farm Advisor, University of California Cooperative Extension, Napa CA; [4]Assistant Professor, Department of Human Environment Systems, Boise State University, Boise ID; [5]Professor, Department of Environmental Science and Policy, University of California, Davis CA; [6]Plant Pathologist, USDA ARS, Department of Plant Pathology, University of California, Davis CA

*Corresponding Author: kaplanj@csus.edu, 916-278-4367

Despite the high likelihood of infection and substantial yield losses from trunk diseases, many wine grape growers wait to adopt field-tested, preventative practices (delayed pruning, double pruning, and application of pruning-wound protectants) until after disease symptoms appear in the vineyard at around 10 years old. We evaluate net benefits from adoption of these practices before symptoms appear in young Cabernet Sauvignon vineyards and after they become apparent in mature vineyards to identify economic hurdles to early adoption. We simulate production in five regions of California and find widespread benefits from early adoption, increasing vineyard profitable lifespans, in some cases, by more than 50%. However, hurdles to adoption may result from uncertainty about the cost and returns from adoption, labor constraints, long time lags in benefits from early adoption, growers' perceived probabilities of infection, and their discount rate. To overcome these hurdles we recommend the development of extension resources to communicate these benefits and potential hurdles to growers to reduce uncertainty, leading to increased early adoption, resulting in greater vineyard profitability and lifespans. In that respect, a web-based resource we developed is introduced that communicates the benefits from, and potential hurdles to early adoption.

Protecting Your Cash Flow Using Whole Farm Revenue Protection (WFRP) and Other Farm Financial Management Tools

Kent Fleming[1], Beau Olen[2*]

[1]Adjunct Professor and Extension Economist; [2]Faculty Research Assistant, Department of Applied Economics, Oregon State University, Corvallis OR

*Corresponding Author: beau.olen@oregonstate.edu, 541-737-1321

Educating growers about Whole Farm Revenue Protection (WFRP) and other farm financial management tools can help them make more informed decisions to protect their cash flow, prevent farm failure, and encourage growth of the Oregon wine industry. Our poster includes an example of how WFRP can protect cash flow, analysis of how other growers have used WFRP, and an evaluation of the return on investment (ROI) from wine grape insurance. We find that the low insurance participation rates in Oregon are not justified by the ROI and that many of the earliest adopters of WFRP were in the Pacific Northwest.

Cash flow is a farm's annual cash income (in flow) minus its cash operating expenses (out flow) for the production year. Cash flow is the most important financial indicator to monitor because it is the primary component of working capital, which is all cash available to the farm in a short time. A farm can have a loss in a given year, but it needs positive working capital every year to continue operating. Thus, protecting cash flow should be growers' highest financial management priority.

One way to prevent negative cash flow is to forward contract sales that lock in a guaranteed price before harvest. This can be used in conjunction with USDA crop yield insurance that guarantees a certain level of production. Another way to prevent negative cash flow is WFRP, which is a USDA crop insurance program that guarantees up to 85% of whole farm revenue. WFRP is available to any farm with up to $8.5 million in revenue and it provides additional subsidies for growing more than one commodity, such as red and white wine grapes. WFRP is the first revenue insurance product available for wine grapes.

Notes:

Oregon State University
Oregon Wine
Research Institute

Oregon Wine Research Institute
4017 Ag and Life Sci Building
Corvallis, OR 97331

www.owri.oregonstate.edu