American Society for Enology and Viticulture-Eastern Section

48th ASEV-Eastern Section Annual Meeting
Cleveland, OH
July 9-11, 2024

Workshop
Small Organisms, Big Impacts: Exploring the Role of Microbes in Vineyard and Winery Management



Email: info@asev-es.org
Website: http://www.asev-es.org/

Conference Overview

Conference Events: Crowne Plaza Cleveland at Playhouse Square

Crowne Plaza Cleveland at Playhouse Square (1260 Euclid Avenue, Cleveland, OH 44115)

Tuesday, July 9, 2024

Conference Registration	Palace Pre-function I&II	**7:00-7:45 am**
Tour Ohio Vineyards & Wineries	Lobby	**7:45 am-9:30 pm**

Wednesday, July 10, 2024

Conference Registration	Palace Pre-function I&II	**7:30 am-5:00 pm**
Welcome and Overview	Palace Ballroom I	**8:00-9:00 am**
Student Poster Flash Talks	Palace Ballroom I	**9:00-9:30 am**
Break/View Posters	Palace Ballroom I	**9:30-10:00 am**
Technical Sessions	Palace Ballroom I	**10:00-11:00 am**
Student Presentation Competition	Palace Ballroom I	**11:00 am-12:00 pm**
Lunch and ASEV-ES Business Meeting	Palace Ballroom II	**12:00-1:45 pm**
Student Presentation Competition	Palace Ballroom I	**1:45-3:00 pm**
Break/View Posters	Palace Ballroom I	**3:00-3:30 pm**
Technical Sessions	Palace Ballroom I	**3:30-4:30 pm**
View Posters	Palace Ballroom I	**4:30-5:30 pm**
Oenolympics & Wines of East Reception	Palace Ballroom II	**5:30-7:00 pm**

Thursday July 11, 2024

Conference Registration	Palace Pre-function I&II	**7:30 am-2:00 pm**
Welcome and Announcements	Palace Ballroom I	**8:00-8:15 am**
Distinguished Service Award	Palace Ballroom I	**8:15-8:45 am**
Technical Sessions	Palace Ballroom I	**8:45-9:45 am**
Break/View Posters	Palace Ballroom I	**9:45-10:00 am**
Poster Flash Talks	Palace Ballroom I	**10:00-10:30 am**
Technical Sessions	Palace Ballroom I	**10:30-11:15 am**
Lunch	Own Your Own	**11:15 am-1:30 pm**
Microbes in Vineyard and Winery Management Workshop	Palace Ballroom I	**1:30-6:30 pm**
Grand Awards Banquet	Palace Ballroom II	**6:30-9:00 pm**

ASEV-ES Conference Sponsors

(Sponsors are recognized throughout the program.)

Tuesday, July 9, 2024

Tour Ohio Vineyards & Wineries

Tour Coordinators: Maria Smith, Todd Steiner, and Imed Dami, The Ohio State University

Meet in Crown Plaza Cleveland at Playhouse Square Lobby 7:45 am

Depart for Gervasi Vineyard Resort and Spa 8:00 am

- Gervasi Introduction and Overview 9:15-9:30 am
- Vineyard/Winery/Estate Tours 9:30-11:15 am
- Grazing Lunch and Tasting at The Cave 11:15 am-12:00 pm
- Market/Distillery 12:00-12:30 pm

Depart for Baci Winery 12:30 pm

- Winery/Tasting Room Tour 2:00-3:20 pm

Depart for Kosicek Vineyards 3:20 pm

- Vineyard/Tasting Room Tour 3:20-4:50 pm

Depart for Ferrante Winery 4:50 pm

- Winery/Vineyard/Tasting Room Tour 4:50-7:00 pm
- Ferrante Winery and Ristorante Dinner with Wine 7:00-8:30 pm

Depart for Crown Plaza Cleveland at Playhouse Square 8:30 pm

Arrive at Crown Plaza Cleveland at Playhouse Square 9:30 pm



Wednesday, July 10, 2024

Welcome 8:00-8:15 am

Moderators: Gill Giese, Arkansas State University/ASEV-ES Chair and Aude Watrelot, Iowa State University/ ASEV-ES Chair Elect

Overview of Enology and Viticulture in Ohio 8:15-9:00 am

Maria Smith and Todd Steiner, The Ohio State University

Student Poster Flash Talks (3 minutes each) 9:00-9:30 am

Haskap Variety and Winemaking Process Evaluations
Aditya Anand, Brent Trela, and Harlene Hatterman-Valenti*

Exploring Genetic Associations of Anthocyanin and Phenolic Compounds in Cold Climate Wine Grape
Rajasekharreddy Bhoomireddy, Ramesh Pilli, Andrej Svyantek, and Harlene Hatterman-Valenti*

Effect of Location and Cultivar on Metabolomic Profile of Pennsylvania Red Wine Grapes
David Campbell* and Joshua D. Lambert

Disease Identification and Management in Cold-hardy Interspecific Hybrid Grapevines
Brooke Dietsch, Randall Vos, Xiaochen Yuan, and Suzanne Slack*

Early Seedling Growth Traits in a Diallel Population of Noir Cold Hardy Grapevines
Elizabeth Krause, John E. Stenger, Harlene Hatterman-Valenti*, and Andrej Svyantek

Grapevine Cane Morphology is Heritable and Can be Altered by Selection
Avery Shikanai, Elizabeth Krause, Hava Delavar, Ozkan Kaya, Andrej Syvantek, and Harlene Hatterman-Valenti*

Supplemental Light Increases Stem Diameter, Foliage and Pruning Weights in *V. vinifera* cv. Cabernet Franc, cv. Chardonnay, and Hybrid cv. Chambourcin
Caleb W. Stephenson and Mark Hoffmann*

Break/View Posters 9:30-10:00 am

Technical Sessions (20 minutes each) 10:00-11:00 am

Dissecting the Genetic Basis of Major Fruit Attributes in Cold Climate Grapes (*Vitis* spp.) of the NDSU Grape Germplasm Enhancement Project
Venkateswara Rao Kadium, Ramesh Pilli, Andrej Svyantek, Zhuoyu Wang, John Stenger, Collin Auwarter, Xuehui Li, and **Harlene Hatterman-Valenti***

Statewide Extension Efforts to Document and Share Wine Grape Cultivar and Vineyard Trends in Pennsylvania
Cain Hickey*, Michela Centinari, Misha Kwasniewski, Flor Acevedo, Molly Kelly, Michael Campbell, Bryan Hed, and Claudia Schmidt

Potential of the Precise Indoor Vine Conditioning (PIVC) Platform in Research, Breeding and Practice
Mark Hoffmann* and Kyle Freedman

Student Oral Presentation Competition (15 minutes each) 11:00 am-12:00 pm

Impact of Alternative Packaging on Vignoles (*Vitis* hybrid) White Wine Quality during Storage
Mark W. Bartz and Renee T. Threlfall*

Plastic Covering Induces Changes in Morpho-Physiological Traits of 'Sauvignon Blanc' Grapevines and Facilitates Grape Production in Tropical Region
Marcella C. C. Daubermann* and Marcel B. Spósito

Exploring a Novel Approach for Cold Hardiness Assessment in Grapevine Mapping Populations
Hava Delavar, A. Fennell, and Harlene Hatterman-Valenti*

Assessing Color and Phenolics of Wines Produced from Co-fermentation of Noble (*Vitis rotundifolia*) and Merlot (*Vitis vinifera*) Grapes
Amanda J. Fleming and Renee T. Threlfall*

Lunch and ASEV-ES Annual Business Meeting 12:00-1:45 pm

Student Oral Presentation Competition (15 minutes each) 1:45-3:00 pm

Evaluating Volatiles Extracted from New York Hardwoods for Viability in Aging Wine and Spirits
Jennifer Neubauer, Christophe Duplais, Peter Smallidge, and Anna Katharine Mansfield*

The Role of Aldehyde Dehydrogenase Proteins in Acetic Acid Production in Table Wine Versus Icewine
Nadine B. Ott-Peon and Debra L. Inglis*

Use of *Saccharomyces uvarum* CN1 to Mitigate Negative Effects of Botrytis and Sour Rot in White Wine
Daniel A. Phillipow, Debra L. Inglis*, and Jennifer Kellyand

Marker Discovery for Adventitious Rooting in Dormant Hardwood Cuttings of Grapevine
S. Jacob Schneider, Li-Ling Chen, and Chin-Feng Hwang*

The Influence of Packaging Material on the Properties of Carbonated Muscadine Wine Under Ambient Storage Conditions
Nicholas A. Wendrick, Andrew J. MacIntosh, and Katherine A. Thompson-Witrick*

Break/View Posters 3:00-3:30 pm

Technical Sessions (20 minutes each) 3:30-4:30 pm

Optimizing 'Chambourcin' Grape Breeding Using Molecular Genetic Approaches
Chin-Feng Hwang*, Li-Ling Chen, Achyut Duwadi, and Tabinda Shahid

Regional Modelling of Vineyard Site Temperature Dynamics with Mobile-transect Techniques
Andrew Kirk*

Use of Differential Thermal Analysis to Determine Grapevine Bud Hardiness on the Texas High Plains
Thayne Montague*, Patrick O'Brien, Daniell Hillin, and Pierre Helwi

View Posters 4:30-5:30 pm

Adjourn 5:30 pm

Oenolympics & Wines of the East Reception 5:30-7:00 pm

USDA NIFA Agriculture and Food Research Initiative (AFRI) Conference Grant Pests and Beneficial Species in Agricultural Production Systems Program (A1112)

USDA National Institute of Food and Agriculture
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Thursday, July 11, 2024

Welcome and Announcements 8:00-8:15 am

Moderators: Gill Giese, Arkansas State University/ASEV-ES Chair and Aude Watrelot, Iowa State University/ ASEV-ES Chair Elect

ASEV-ES Distinguished Service Award 8:15-8:45 am

Career Highlights in the Grape and Wine Industry

Paul Read, Nebraska State University-Lincoln

Technical Sessions (20 minutes each) 8:45-9:45 am

"Good Wine from Bad Grapes?": Quantifying the Effects of Incremental Proportions of Sour Rot Affected Fruit in White and Red Winemaking
Andrew Kirk*, Lori Lee, Gary Misich, Aaron Jaskiewicz, and Patrick Turner

Managing Grapevine Powdery Mildew with Ultraviolet-C Light
Alexa McDaniel*, Maria Mireles, David Gadoury, and Michelle Moyer*

Impact of Yeast Strains on a Value Added Product Made from Grape Pomace
Aude A. Watrelot*

Break/View Posters 9:45-10:00 am

Poster Flash Talks (3 minutes each) 10:00-10:30 am

Development and Field-deployment of a Novel Auxinic Herbicide Detection System
Maria Smith, Yun Lin, Jinshan Lin; and **Joshua Blakeslee***

Evaluating Use of Vine Shelters to Reduce Cold Injury in New Vineyard
Michael Cook and Justin Scheiner*

Foliar Potassium Fertilizer Increases Berry Sugars and Bud Cold Hardiness of *Vitis* sp. Chambourcin
Gurkirat Singh, Andrea R. Gschwend, and **Imed E. Dami***

Using Whole Genome Sequencing for the Identification of Wild *Vitus riparia* Clones
P. Liang, R. Robertson, and **K.H. Fisher***

Exploring Shifts in Wine Consumption and Purchasing Experiences Among Mid-Atlantic Consumers before, during, and after the Pandemic
Justin Gaiser, Julia Ciaccia, John E. Hayes, and Helene Hopfer*

Physical and Molecular Defenses that Contribute to *Vitis labrusca* Resistance to Japanese Beetles
Cullen W. Dixon and **Andrea R. Gschwend***

Pruning Strategies when Using Geotextile as Winter Protection
Andreanne Hebert-Hache* and Caroline Provost

eDNA Collection Case Study for Spotted Lanternfly in Cleveland, Ohio
Daiyanera Kelsey, Jonathan Lee-Rodriguez, Andrew Michel, and Ashley Leach*

Pinot Noir Clones Differ in Response to Early Leaf Removal (ELR) Treatment
Andrew Kirk* and Maria Smith

Evaluating the Performance of Camminare Noir in Texas
Susan Webb, Michael Cook, and Justin Scheiner*

Technical Sessions (20 minutes each) 10:30-11:15 am

Surveying U.S Fresh-market Grape Consumers to Determine Key Attributes and Willingness to Pay
Renee Threlfall*, Margaret Worthington, Melinda Knuth, Di Fang, Wei Yang, Amanda Fleming, Penny Perkins-Veazie, and Mark

Could We Use Grape Stems to Improve Red Wine Quality?
Aude A. Watrelot* and David Carter

Industry Workshop

1:30-6:30 pm

Small Organisms, Big Impacts: Exploring the Role of Microbes in Vineyard and Winery Management

Presentations, Interactive Discussions, and Tastings

This workshop addresses has keynote speakers that will address the role of microbes in challenging U.S. grape and wine production areas.

Welcome and Introductions — **1:30-1:45 pm**
Moderators: Maria Smith and Todd Steiner, The Ohio State University

Minimizing Fungicide Resistance in Grapes — **1:45-2:30 pm**
Phil Brannen, University of Georgia

Spotted Lanternfly Impacts on Grapevine Health and Fruit and Wine Quality — **2:30-3:15 pm**
Drew Harner, Virginia Tech

Break/View Posters — **3:15-3:30 pm**

The Existential Question of Spontaneous Fermentations — **3:30-4:30 pm**
Anna Katharine Mansfield Cornell University

Developing Effective Control and Monitoring Program to Prevent Wine Microbial Spoilage — **4:30-5:15 pm**
James Osborne, Oregon State University

Modern Bioprotection for the Winemaker — **5:15-6:00 pm**
Katie Cook, Scott Laboratories

Wrap Up and Adjourn — **6:00-6:30 pm**

ASEV-ES Grand Awards Banquet — **6:30-9:00 pm**

Workshop Speakers

Phil Brannen is a Professor in the Plant Pathology Department at the University of Georgia. He attended the University of Georgia for his undergraduate degree in Plant Protection and Pest Management, where he also received an M.S. in Plant Pathology, followed by a Ph.D. in Plant Pathology from Auburn University. He has extensive experience with disease management programs in numerous cropping systems. He serves as the extension fruit pathologist for Georgia – conducting research and technology transfer for multiple fruit commodities. His efforts are directed towards developing IPM practices to solve disease issues and technology transfer of disease-management methods to commercial fruit producers. He also teaches the graduate level Field Pathology Course, the History of Plant Diseases and their Impact on Human Societies Course, team-teaches the IPM Course, coordinates the Viticulture and Enology in the Mediterranean Region Course (Cortona, Italy), and guest lectures in numerous other courses throughout the year.



Katie Cook is a Field Sales Representative (Northeast & Upper Midwest) for Scott Laboratories. She fell in love with the wine industry in 2004 while taking a course in the south of France which led to harvest internships in California, Argentina, and Australia. She completed a master's in Enology (Diplôme National d'Œnologue) at the University of Burgundy in 2009 and worked three harvests in France while getting her degree. In 2010 she accepted a position as the Enology Project Leader for the University of Minnesota, which gave her good experience working with cold-hardy hybrids. In 2014 she moved to the Finger Lakes, NY with her husband where she spent several years working in production again before accepting a position with Scott Labs as their sales rep for the Northeast.



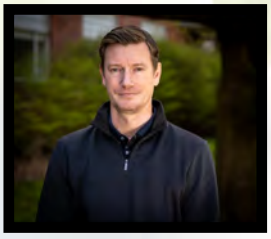
Drew Harner is an Assistant Professor of Viticulture and State Extension Specialist at Virginia Tech's Alson H. Smith Jr. Agricultural Research and Extension Center (AREC) in Winchester, Virginia, which he joined in January 2024. He received his B.S. in Viticulture and Plant Science from Cornell University in 2016 and his Ph.D. in Horticulture from Penn State University in 2022, where he studied with Dr. Michela Centinari. Dr. Harner's research currently focuses on grapevine nutrition under Mid-Atlantic conditions, assessing novel production methods and varieties to meet the challenges of increasingly variable growing conditions, and fruit and vine responses to Spotted Lanternfly infestation and sap-feeding.



Anna Katharine Mansfield is an Associate Professor of Enology, Director of the Cornell Craft Beverage Institute, and Associate Director of Cornell AgriTech in Geneva, NY. She received a BA in English from Salem College and graduate degrees in Food Science at Virginia Tech and the University of Minnesota. Dr. Mansfield served as Enology Project Leader at the University of Minnesota from 2001-2008, where she developed a new enology extension program to serve the rapidly-developing cold-climate wine industry in the Upper Midwest. She has been a member of the Cornell Enology Extension Lab since 2009, where she strives to aid regional wineries through outreach and applied research on hybrid wine phenolics and proteins, fermentation nutrition, and regional typicity. Dr. Mansfield has served as a board member of the ASEV-ES from 1998-2012 and 2020-22, as chair of the ASEV-ES Oenolympics since 2010, and as a board member of ASEV since 2019.



James Osborne is the Director of the Oregon Wine Research Institute and a Professor and Enology Extension Specialist in the Food Science and Technology Department at Oregon State University. He received his PhD from Washington State University in 2005 researching interactions between wine yeast and bacteria after which he spent time in his native New Zealand working at the University of Auckland. His research focuses on the impact of wine lactic acid bacteria, *Brettanomyces*, and non-*Saccharomyces* yeast on wine quality James provides outreach programs for the Oregon wine industry such as technical workshops and seminars to aid in the transfer of relevant research results to winery application. In addition, James teaches undergraduate and graduate classes in support of the enology and viticulture program at Oregon State University.



2024 ASEV-ES Distinguished Service Award

Paul Read

Professor, University of Nebraska-Lincoln



Dr. Paul E. Read is a Professor of Horticulture and Viticulture at the University of Nebraska, Lincoln, Nebraska. Paul is a New York native, growing up on a small farm in the Finger Lakes Region. He obtained B.S. and M.S. degrees from Cornell University, sandwiched around three and a half years as a county extension agent in Fulton County, New York. Following obtaining a PhD in Biological Sciences at the University of Delaware, he served on the Horticultural Science faculty at the University of Minnesota for 19 years. He was then recruited to fill the Head of the Horticulture Department position at the University of Nebraska where he now serves as the resource person for Nebraska's developing grape and wine industry. During this time he worked two vintages in Australia, collaborating with Rob Walker and Peter Clingelheffer at CSIRO and Richard Smart and Steve Wilson at the University of Tasmania. His research and educational programming in Nebraska have focused on cultivar and genotype evaluation, vineyard floor management, trellising, disease management, high tunnel grape production and more recently on crop load impact on grape and wine quality. He was recognized by the Nebraska Winery and Grape Growers Association with their Pioneer Award and is a Lifetime Member of the NWGA. Dr. Read has taught numerous courses during his career and continues to teach the popular "Vines, Wines and You" at the University of Nebraska. He also received the Darrell W. Nelson Excellence in Graduate Education Award at University of Nebraska, having mentored over 80 M.S. and PhD students. Paul has been active in numerous professional groups and scientific societies. He served as the President Elect, President and Chairman of the Board of the American Society for Horticultural Science, following selection as an ASHS Fellow. He also received the ASHS Outstanding Graduate Educator Award, and chaired and served on numerous ASHS committees and groups. He has been an active member of the American Society of Enology and Viticulture and the ASEV- Eastern Section, frequently attending ASEV meetings and continuously participating in ASEV-ES conferences. Paul recently filled the positions of Chair-elect, Chair and the Past-Chair on the ASEV-ES Board and assisted with other ASEV-ES committees and services. Paul is a founding member of the American Chestnut Foundation, serving as Vice-president and President. He also was a charter member of the (now defunct) Plant Growth Regulator Society of America (PGRSA) also serving as President. Other activities have included the American Wine Society, The Australian Society of Viticulture and Oenology, Board of Directors for the Omaha Botanical Garden, International Plant Propagators Society, the American Horticultural Society, the Nebraska Statewide Arboretum (Interim Director), the Royal Horticulture Society (UK), International Association of Plant Tissue and Organ Culture, and many other civic and professional organizations.

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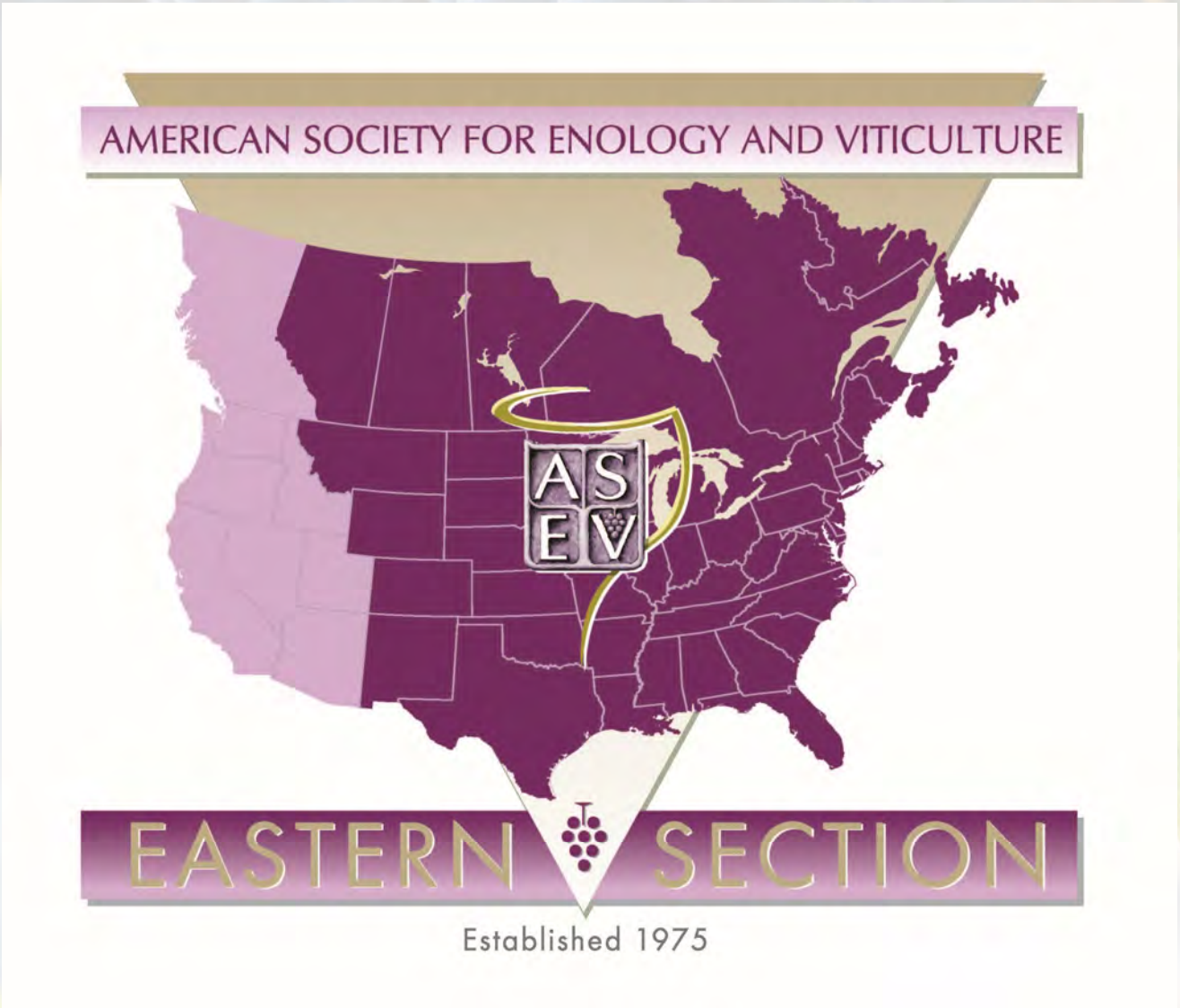
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About ASEV-Eastern Section

Our mission is to provide forums for the presentation, discussion, and publication of research and technology developments for the advancement of wines and the solution of problems of specific interest to the enology and viticulture of grapes grown in the Eastern United States and Canada.

ASEV-Eastern Section Regions

The ASEV-Eastern Section's geographical area includes all U.S. states and Canadian provinces with territory east of the Continental Divide.



2024 ASEV-ES Scholarship Recipients



Michael Cook, Texas A&M University

Amanda Fleming, University of Arkansas

Nadine Ott-Peon, Brock University

Faith Twinamaani, Cornell University

Nicholas Wendrick, University of Florida









2024 Scholarship Fundraiser Raised over $8,000

The ASEV-ES works every year to raise scholarship funds for students working toward careers in viticulture and enology. ASEV-ES typically awards graduate students a $1,000 scholarship (in addition to conference registration and lodging). Thanks to Eastern Winery Exposition and scholarship donors for your contributions.

Donate to the ASEV-ES Scholarship Fund at http://asev-es.org/PaypalASEVES.php

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Andrej Svyantek (Bronze Donor)

Student Presentation Competition Abstracts

Abstracts ordered alphabetically by last name of presenting author in bold

Impact of Alternative Packaging on Vignoles (*Vitis* hybrid) White Wine Quality during Storage

Mark W. Bartz and Renee T. Threlfall*
*Corresponding author: University of Arkansas, Department of Food Science, 2650 North Young Avenue, Fayetteville, AR 72704, USA, rthrelf@uark.edu

The sustainability of grape (*Vitis* species) wine production is impacted by costs and supply-chain issues with glass packaging. Alternative packaging, like aluminum and plastics, can be used but can impact quality and consumer perception. The impact of wine packaging on color and total phenolics of Vignoles (*Vitis* hybrid) white wine was evaluated during storage at 15Â°C for 0-, 6-, and 12-months. Grapes were harvested in 2022, produced into wine, and bottled in January 2023. Eight wine packaging treatments were evaluated including three glass treatments (250 mL, 375 mL, and 750 mL) and five 250-mL containers of aluminum, Polyethylene Terephthalate (PET), High-Density Polyethylene (HDPE), Low-Density Polyethylene (LDPE), and Polypropylene (PP). The packaging x storage interaction was significant for L*, hue, chroma, brown color, and total phenolics. For wine at 0-month compared to 12-months storage, all packaging treatments except Glass (375 and 750) had decreased L* and hue and increased chroma and brown color, and all packaging treatments had decreased total phenolics. After 12-months storage wine in Glass 250, 375, and 750 had 35%, 0%, and 1% more brown color, respectively. Wine in LDPE, HDPE, and PP had over 100% more brown color after 6-months storage and over 230% after 12 months, while wine in PET and aluminum had 45% and 28%, respectively after 6-months storage and over 149% after 12-months. Wine in traditional glass bottles (375 mL and 750 mL), 250 mL glass, aluminum, and PET had the most potential for further investigation of the impact of packaging on wine quality.

Plastic Covering Induces Changes in Morpho-Physiological Traits of 'Sauvignon Blanc' Grapevines and Facilitates Grape Production in Tropical Region

Marcella C. C. Daubermann* and Marcel B. Spósito
*Corresponding author: North Carolina State University, 2721 Founders Dr, Raleigh, NC 27607, USA, mcdauber@ncsu.edu

Grapevines are cultivated on a large scale in Brazil, with a production of 1.4 million tons in 2022. This production is divided between the fresh fruit market and processing for juice and wine. However, in Brazil, grapevine cultivation faces limitations due to weather and geographic conditions, impacting management strategies and production cycles. To overcome these challenges and increase production, new techniques and technology have been adopted. The double pruning consists of one conventional pruning after harvesting, in winter, and another pruning at the end of summer. Plastic coverings for plants are utilized to mitigate issues related to diseases such as downy mildew and bunch rot. This study aimed to evaluate the use of plastic covering or not with double pruning on the physiology and anatomy of cv. Sauvignon Blanc grapevines. Plants covered with polypropylene plastic, transmitting 70% to 80% of solar radiation, showed superior performance compared to uncovered plants, displaying increased growth, with higher height and greater stem diameter. Furthermore, covered plants showed higher photosynthetic rates, transpiration, stomatal conductance, and chlorophyll content. Uncovered plants had increased leaf epidermis and palisade parenchyma thickness. Unlike covered plants, uncovered plants displayed epicuticular wax over the stomata, indicating possible plasticity to support high light intensity and temperatures. Therefore, our results suggest that double pruning alone did not significantly enhance the performance of cv. Sauvignon Blanc vines. However, when combined with plastic covering, it created a favorable microenvironment, enabling improved growth and physiological activity, primarily driven by enhanced photosynthetic rates and stress-induced morphological changes.

Exploring a Novel Approach for Cold Hardiness Assessment in Grapevine Mapping Populations

Hava Delavar, A. Fennell, and Harlene Hatterman-Valenti*
*Corresponding author: North Dakota State University, Department of Plant Sciences, 1360 Abrecht Boulevard, Fargo, ND 58102, USA, h.hatterman.valenti@ndsu.edu

Cold hardiness is an economically important trait that can significantly affect grape production and quality. Until now, there have been no reports on identifying effective quantitative trait loci (QTL) for cold hardiness in grapevines. The bottleneck of QTL mapping of cold hardiness in grapes and other fruit trees is field evaluation, due to the fact that vulnerable plants to cold often die in their first year of planting. To address this, our study focuses on developing a method that involves acclimating the entire mapping population in the greenhouse with controlled photoperiod and temperature, allowing for a comprehensive assessment of both cold-susceptible genotypes and cold-hardy ones by using differential thermal analysis. For this purpose, a mapping population resulting from a cross between *Vitis riparia* and *Vitis vinifera* underwent cold hardiness evaluations under three distinct environments: 1) acclimated in a cold region of North Dakota that experiences temperatures as low as -35 C during winter 2) acclimated in a greenhouse, where photoperiod and temperature were controlled; and 3) acclimated in the temperate climate of California, devoid of any cold stress. This research can speed up the breeding processes, as evaluation in the greenhouse can be done at any time of the year and will not be limited to the winter season. Data analysis for the study is ongoing, and thus, the findings have not been disclosed at this stage. We anticipate completing the requisite analyses and presenting the results by the time of the Conference.

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Student Presentation Competition Abstracts

Assessing Color and Phenolics of Wines Produced from Co-fermentation of Noble (*Vitis rotundifolia*) and Merlot (*Vitis vinifera*) Grapes
Amanda J. Fleming and Renee T. Threlfall*
*Corresponding author: * University of Arkansas, Department of Food Science, 2650 North Young Avenue, Fayetteville, AR 72704, USA, rthrelf@uark.edu
Muscadine grapes (*Vitis rotundifolia* Michx) are used for wine production but can have issues with color and phenolic stability. In 2023, Noble (*V. Muscadinia*) and Merlot (V. vinifera) grapes were harvested, randomized into five co-fermentation treatments in duplicate (100% Noble, 75% Noble+25% Merlot, 50% Noble+50% Merlot, 25% Noble+75% Merlot, and 100% Merlot), processed, and fermented. At bottling, SO_2 was added to each co-fermentation treatment at different molecular levels (0.0, 0.8, and 1.5 mg/L) and evaluated for color and phenolic stability. At bottling, wine pH (3.24-3.67), titratable acidity (0.60-0.80%), free SO_2 (18.53-42.43 mg/L), and ethanol (10.35-13.64%) varied for each co-fermentation treatment. The co-fermentation x SO_2 interaction was significant for L*; 100% Noble without SO_2 had the lowest L* and 100% Merlot with 1.5 mg/L SO_2 had the highest. As Noble increased in each co-fermentation treatment, red color, brown color, color density, total phenolics, and total anthocyanins increased. Wines without SO_2 had higher red color, brown color, and color density compared to wines with 0.8 and 1.5 mg/L SO_2. Wines with 100% Noble had the highest total phenolics (2,037 mg gallic acid/L) and total anthocyanins (1,712 mg/L) compared to 100% Merlot (884 mg gallic acid/L and 296 mg/L, respectively). At bottling, wines with ≥25% Noble had higher color and phenolic content compared to 100% Merlot wines. Blends with more Merlot had more SO_2 bleaching with lower phenolic and color content at bottling, whereas wines co-fermented primarily with Noble grapes, had darker color and higher phenolics at bottling.

Evaluating Volatiles Extracted from New York Hardwoods for Viability in Aging Wine and Spirits
Jennifer Neubauer, Christophe Duplais, Peter Smallidge, and Anna Katharine Mansfield*
*Corresponding author: Department of Food Science, Cornell University, Cornell AgriTech, 665 West North Street, Geneva, NY 14456, USA, akm87@cornell.edu
In 2024, *Quercus alba* is synonymous with barrel aged wine and spirits; there are concerns demand will eventually outstrip future timber supply. Exploring regional *Q. alba* sources and alternative wood species for aging beverages addresses *Q. alba* supply issues and deepens exploration of regional beverage styles. A characterization of volatiles is necessary to evaluate new species' suitability for aging wine and spirits. Wood samples from five species (*Q. alba, Fraxinus americana, Prunus serotina, Robinia pseudoacacia, Acer saccharum*) were toasted at six treatment levels to simulate commercial barrel toasting temperatures. Wood shavings were aged three weeks in two solutions, a white wine and 45% (v/v) hydroalcoholic solution. A solid phase extraction method was used to prepare samples for Gas Chromatograph Mass Spectrometer (GC-MS) analysis. Volatiles were tentatively identified via spectra after peaks were extracted using MS-DIAL and semi-quantified using reference compounds in Agilent Massworks Quantitative Software. Several compounds were present in both untoasted and toasted samples for at least one species: guaiacol, vanillin, lactones, syringol. The largest number of compounds was detected at 180°C. Vanillin, furfural and syringaldehyde concentrations increased at higher temperatures. General qualitative differences separated *F. americana*, *A. saccharum* and *P. serotina* from the *Q. alba* and *R. pseudoacacia*. Preliminary data indicates there may be differences in both lignin- and hemicellulose-derived volatile chemistry between species. Additional research is required to evaluate wood suitability for commercial production under more controlled conditions and a larger sample size. New York timber has not been studied previously, nor have the species *P. serotina* and *A. saccharum*.

The Role of Aldehyde Dehydrogenase Proteins in Acetic Acid Production in Table Wine Versus Icewine
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Canada is known for Icewine which is fermented from grapes naturally frozen on the vine. Grapes are harvested below –8°C and pressed while frozen, trapping ice crystals inside the berries and releasing juice highly concentrated in sugars and acids. The high sugar juice environment (40°Brix) causes hyperosmotic stress for yeast, resulting in water loss, triggering glycerol production to act as an internal osmolyte to draw water back into the yeast cell, resulting in an NAD+ imbalance. Icewine has significantly higher acetic acid versus table wine, where acetic acid production may be used to reduce NAD+ to NADH via an NAD+-dependent aldehyde dehydrogenase (Aldp). Previous research identified the NAD+redox imbalance during Icewine fermentation while gene expression patterns indicated a role of Ald3p encoded by ALD3 in elevating the acetic acid whereas in table wine, ALD6 expression dominated. The objective of this project is to remove each of the 5 ALD genes individually from the genome of a commercial wine yeast K1-V1116 using CRISPR-cas9 gene editing and then determine the roles of the aldehyde dehydrogenase proteins in acetic acid production in both Icewine and table wine using these commercial yeast deletion strains. All copies of ALD5 and ALD6 were successfully knocked out of K1-V1116. Ald6p was found responsible for the majority of acetic acid during table wine fermentation, but not all acetic acid. With ALD 6 deleted 0.028 g/L acetic acid was produced compared to the control which produced 0.189 g/L. Icewine fermentations are now underway to compare the differing response.

Use of *Saccharomyces uvarum* CN1 to Mitigate Negative Effects of Botrytis and Sour Rot in White Wine
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Sour rot and Botrytis infections pose significant challenges to grape growers and wineries, negatively impacting wine quality and thereby affecting industry financial sustainability. Infected fruit exhibits elevated concentrations of acetic acid, glycerol, acetaldehyde, and ethyl acetate, compounds known to unfavorably alter wine sensory characteristics. Wineries establish juice thresholds for the concentration of acetic acid as a measure of infection, which when surpassed, necessitates rejection of entire loads, resulting in financial losses and disrupted production schedules. A locally isolated yeast, *Saccharomyces uv*arum CN1, shows promise for grape growers and wineries in managing acetic acid. Previous research on red wine fermentations showed CN1 metabolized acetic acid while simultaneously increasing volatile aroma compounds (VOCs) compared to commercial S. cerevisiae strains. However, studies have not extended to aromatic white wine fermentations. In this study, fermentations utilizing Riesling grapes with various degrees of rot infection were conducted by inoculating must with either CN1 or commercial S. cerevisiae EC1118. Wines fermented using CN1 showed a significance decrease in acetic acid when compared with the values in juice. In comparing acetic acid in wines fermented between CN1 and EC1118, CN1 showed a 13-fold decrease in 0% rot infection, a 6-fold decrease in the 20%, and a 5-fold decrease in the 40% lowering the acetic acid in wine to only 0.05-0.02g/L. The ability of CN1 to ameliorate sour rot and Botrytis contamination in grape must holds promise for a transformative opportunity for winemakers to produce quality wines from fruit previously deemed unusable.

Student Presentation Competition Abstracts

Marker Discovery for Adventitious Rooting in Dormant Hardwood Cuttings of Grapevine

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In the grape and wine industry, vegetative propagation by dormant hardwood cuttings is the preferred production method for large quantities of planting stock. Unfortunately, not all grapevines are easy to root via hardwood cuttings. *Vitis aestivalis*-derived 'Norton' grows natively in the Midwest and eastward to the coast, yet a limiting factor in 'Norton' propagation is that it is difficult to root (recalcitrant) via dormant hardwood cuttings. This results in limited availability of planting stock to meet grower needs. Breeding 'Norton' with a less recalcitrant premium cultivar, like *V. vinifera* 'Cabernet Sauvignon', could improve availability of planting stock while providing a new quality hybrid wine-grape. To date, this cross has produced an F1 mapping population of 300 interspecific hybrids segregating for dormant rooting. A linkage map based on this population was constructed with 377 simple sequence repeat (SSR) markers and 1319 rhAmpSeq-derived markers (haplotype markers based on single nucleotide polymorphisms, via amplicon sequencing). Total map size was 1663.05 cM with an average inter-marker distance of 0.9 cM, and no gaps greater than 10 cM, across 19 linkage groups. This study aims to associate key rooting-ability traits, such as root number and longest root, with the marker locations on the linkage map. Thus, enabling detection of quantitative trait loci (QTL) for rooting ability in hardwood cuttings. Initial analysis indicates two potential QTL, one for each trait: Number of adventitious roots had a QTL on LG 13 (LOD 4.5), and longest main root had a QTL on LG 5 (LOD 6.1), each with flanking rhAmpSeq-derived markers.

The Influence of Packaging Material on the Properties of Carbonated Muscadine Wine Under Ambient Storage Conditions

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Wine is a complex beverage containing an array of flavor compounds generally derived from volatile organic compounds (VOCs) and basic tastes attributed to sugars (sweetness), organic acid (sourness), and polyphenols (bitterness/astringency). These components may interact with the packaging material, significantly affecting the consumer experience. Alternative packaging has been gaining popularity with consumers due to portability, convenience, and recyclability. This project investigated the chemical changes in carbonated muscadine wine packaged in aluminum cans and glass bottles at ambient temperatures (25°C) for 180 days to parse the capacities of alternative packaging. Noble muscadine wine was packaged in cans and bottles with the pH, titratable acidity, free and total sulfites, sugar, alcohol, color, flavor compounds, and anthocyanins assessed. Surprisingly, there was no significant difference ($p < 0.05$) in several analyses, notably the VOCs and anthocyanins. Despite the non-significant difference in VOCs, the overall aroma composition showed little to no deterioration throughout the study. One critical change was a 53% reduction in anthocyanin concentration (4,506 mg/L to 2,096 mg/L) across six months. Moreover, there was a significant decrease in spectrophotometric color intensity and a significant increase in color hue between packages. Additionally, cans significantly outperformed bottles in free and total sulfite concentration, with a decreased free concentration from 15.8 mg/L to below the detection threshold in bottles by day 90 and stabilizing at 6.7 mg/L in cans ($p < 0.05$). These research findings suggest that bottles and cans exhibit comparable chemical changes over time, supporting cans as a viable alternative package.

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Technical Session Abstracts

Dissecting the Genetic Basis of Major Fruit Attributes in Cold Climate Grapes (*Vitis* spp.) of the NDSU Grape Germplasm Enhancement Project

Venkateswara Rao Kadium, Ramesh Pilli, Andrej Svyantek, Zhuoyu Wang, John Stenger, Collin Auwarter, Xuehui Li, and **Harlene Hatterman-Valenti***

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Hybrid grapevines (*Vitis* spp.) commonly grown in cold climate regions have varying fruit chemistry when compared to traditional European wine grapes (*V. vinifera* L.) due to the novel breeding work which builds on wild *Vitis* specimens environmental, disease, and pest tolerances. Understanding the genetic basis of important fruit chemistry traits is one method to accelerate targeted breeding for fruit quality objectives in interspecific grapevine populations. This study targeted ten fruit attributes: total soluble solids, pH, total acidity, sugars (glucose and fructose), acids (malic, tartaric, and citric), yeast assimilable nitrogen, and berry mass. In Fargo, ND, USA, an interspecific breeding population was phenotyped for three consecutive years (2020 to 2022); during each year, trait measurements were conducted at three different time points for a total of nine cumulative phenotyping events. The best linear unbiased predictors (BLUPs) calculated from multi-year phenotype data were used as the response variables. Subsequently, this population was genotyped with ~21000 SNP markers. Genome wide association analysis was performed to identify marker-trait associations. Chromosomes 16, 6, and 17 were observed to have the greatest portion of marker-trait associations. Gene annotation was conducted for the surrounding 20 kb region for each significant association to reveal important genes related to trait expression. This analysis provides essential information regarding the genetic factors driving major fruit traits in interspecific breeding populations; these results can be applied via marker-assisted selection in this population with work on-going to assess cross population applicability towards the goal of rapidly improving lines for growers and winemakers.

Statewide Extension Efforts to Document and Share Wine Grape Cultivar and Vineyard Trends in Pennsylvania

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The Pennsylvania Grape and Wine Industry is characterized by a diverse range of growing regions. This means that cultivar types, growth stage progression, and ripening parameters vary across the state. This also means that communication and collaboration across the entire state requires investment of resources - namely, time and money. The Penn State Extension Grape and Wine Team has coordinated three statewide, industry-facing projects to characterize trends across the Pennsylvania grape and wine industry. With the support of state funding, the team has coordinated statewide, "citizen science" projects to learn more about cultivar choices and traits, growth stage progression, and ripening patterns. Cultivars in the Commonwealth, an online tool reviewing cultivar traits across Pennsylvania, was published in April 2022. Traits concerning viticulture, enology, and consumer demand were summarized across 40 cultivars and 24 counties in Pennsylvania. Phenology progression was collected across the state in 2022 and 2023. Trends suggested that bud break tended to be earlier in 2022 than in 2023 but location impacted bud break differences across the years. The 2023 vintage marked the inaugural season for Post-Veraison in Pennsylvania, a weekly grape maturation report for the Pennsylvania grape and wine industry. With some exceptions, trends generally suggested that maturation started earlier, and harvest date occurred earlier, in southeastern Pennsylvania relative to central, southwestern, and northwestern Pennsylvania. Observations from these three initiatives will be reviewed in greater depth during this session.

Potential of the Precise Indoor Vine Conditioning (PIVC) Platform in Research, Breeding and Practice

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Precise Indoor Vine Conditioning (PIVC) is using Controlled Environment Agriculture (CEA) technology to improve grapevine transplant growth and fruitfulness. The original goal was to develop grape transplants that can be fully cropped in the same year of planting. Shortening the time between planting and first harvest was mainly a potential solution in response to Eastern Shore problems due to disease and weather impact on vine survival and vineyard aesthetics. Recent experiments on 'Traminette', 'Chardonnay', 'Chambourcin' and 'Cabernet Franc' have shown that supplemental light treatments with 300 PPFD can improve fruitfulness by as much as 50%, compared to controls. In 'Traminette', secondary and tertiary bud fruitfulness linearly increased with increased supplemental light levels. Vines that are treated under supplemental light develop significantly thicker stem diameter and more leafs, compared to controls. The current PIVC platform allows us to precisely control the light environment, water, nutrition and temperature to a certain degree. This circumstance opens up the PIVC platform for a range of applications, from enhancing potential breeding processes (speed breeding) to answering very fundamental plant physiological questions. While still a work in progress, in this talk we will discuss the current PIVC platform in detail, summarize preliminary results from 3 years of research and development and its potential for applications in breeding and research.

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Technical Session Abstracts

Optimizing 'Chambourcin' Grape Breeding Using Molecular Genetic Approaches
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Vitis interspecific hybrid 'Chambourcin', a French-American hybrid, is a popular red wine grapes in mid-Atlantic and Midwestern United States including Missouri. It exhibits greater cold hardiness and disease resistance than *V. vinifera* cultivars. However, the genetic resources are lacking for 'Chambourcin', and its current genomic analyses are extremely limited. In view of this, a mapping population of 273 F1 individuals was developed from crosses of 'Chambourcin' and *V. vinifera* 'Cabernet Sauvignon'. The purpose of generating these hybrids is to create a cultivar with the disease resistance and cold hardiness of 'Chambourcin' combined with the superior wine quality of 'Cabernet Sauvignon.' A genetic linkage map using this mapping population was constructed with 355 simple sequence repeats (SSR) and 1,394 RNaseH2-dependent amplicon sequencing (rhAmpSeq)-derived haplotype markers that clustered into 19 linkage groups (LGs) with a genetic distance of 1,695.0 centimorgan (cM). Careful genetic analysis of this population will provide the foundation and tools to associate molecular markers with favorable traits including disease resistance, cold hardiness and berry quality. We are currently working on the localization of DNA markers tightly linked to several quantitative trait loci (QTLs) for future marker-assisted selection. Preliminary data will be further presented and discussed. The ultimate goal of this breeding program is to use genetic markers to improve efficiency of progeny/hybrid selection, rapidly deploy favorable alleles, and accelerate breeding cycles for new cultivar releases.

Regional Modelling of Vineyard Site Temperature Dynamics with Mobile-transect Techniques
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An Ohio State University research project in 2019 and 2020 aimed to produce an empirical model for modelling temperature patterns in the Grand River Valley region of Ohio during radiative and advective cold events. The aim was to create site selection guidance specifically for that region and explore the suitability of this approach for other regions. Utilizing a methodology from the climatological research field, known as "mobile transect temperature modelling", the researcher mounted a Vaisala HMP 110 multi-sensor probe, and a Trimble R1 GPS, to a pickup truck and collected data during six advective and five radiative cold events in 2019 and 2020. Temperature, relative humidity, dew point, latitude, longitude, and elevation were collected during the logging sessions. Temperature observations logged across the area were indexed to a centrally located weather station in Geneva, OH. Absolute Elevation (ft) was strongly negatively correlated (r= 0.811) with relative temperature across six advective cold logging events. Absolute Elevation, Distance from Lake Erie, Lake Erie temperature, and directional orientation from Lake Erie produced a linear model with high explanatory power (r2= 0.77) for modelling relative temperature during advective cold events. Conversely, inconsistent positive and negative correlations were observed between relative temperature and elevation within and across five radiative cold events. Results suggest that site selection guidance should differentiate between expected performance of site locations during advective and radiative cold events. The variable and inconsistent patterns observed in radiative cold events highlight the limitation of site selection as a form of passive cold protection.

"Good Wine from Bad Grapes?": Quantifying the Effects of Incremental Proportions of Sour Rot Affected Fruit in White and Red Winemaking
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A collaborative team from Ohio State University and Kent State University seek to provide insight on whether it is possible to make acceptable wine from compromised fruit. The research team harvested 1600 lbs of Pinot Noir and Pinot Gris fruit, which was then sorted into three groups ("Clean", "Somewhat Rotten", and "Very Rotten"), corresponding to 0% Rot-Affected, 50% Rot-Affected, >75 % Rot-Affected. Pinot Gris grapes from all groups were crushed, pressed, fermented, and subjected to iterative potassium metabisulfite additions pursuant to 0.8 mg/L Molecular SO2. Similar was done for Pinot Noir grapes, except that skins remained in contact during fermentation. All treatments had four replications. Wines were bottled upon clarification and reaching 0.8 mg/L Molecular SO2. After bottling, the following were collected at 3-month intervals: pH, ethanol %, titratable acidity (TA), volatile acidity (VA), and free SO2. At 1-year post-bottling, 2022 Pinot Gris wines from all groups were stable at near or below detection levels for VA. No differences in VA were observed between the groups. Conversely, in the 2022 Pinot Noir, only wines from the "Clean" group remain without detectable VA concentrations at 1-year post-bottling. The other Pinot Noir treatment groups have been unstable with increasing levels of VA. Ethanol, TA, VA, and pH also demonstrated statistical differences between treatment groups in both experiments. Efforts continue in 2024. Diverging outcomes for the red and white winemaking experiments suggest that more nuanced guidance may be appropriate with regards to Sour Rot tolerance in red and white winemaking.

Managing Grapevine Powdery Mildew with Ultraviolet-C Light
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Nighttime applications of germicidal ultraviolet-C light (UV-C) have suppressed plant pathogens, including *Erysiphe necator*, which causes grapevine powdery mildew (GPM). We evaluated its effects on GPM and berry quality in a mature *Vitis vinifera* 'Chardonnay' vineyard in eastern Washington (2020-2022). UV-C (200 J/m2) was applied to replicated plots weekly in 2020 and weekly or twice-weekly in 2021 and 2022, 30 minutes post-sunset with an over-the-row lamp array from 7-15 cm shoot growth until 3-weeks post fruit set. Unsprayed and fungicide program control plots were included. Disease severity was rated on leaves and clusters bi-weekly from bloom until harvest. Disease severity was too low on the unsprayed control in 2020 and 2021 for practical separation of treatment effects, however there was a trend towards increased suppression of GPM with more frequent UV-C intervals. In 2022, when foliar GPM reached a severity of 100% on the unsprayed control, weekly UV-C reduced foliar disease by 37% (p=0.03) and twice-weekly by 61% (p=0.0003), and cluster disease was reduced by 40% (p=0.0001) with twice-weekly UV-C and 16% (p=0.03) with weekly UV-C. Harvest metrics were not impacted by UV-C. In 2020, there was an increase in total skin phenolics with weekly UV-C (p=0.009) though this was not seen in 2021 and 2022. The reduced severity of GPM following weekly or twice-weekly applications of UV-C, particularly under higher disease pressure, and the consistent lack of harm to leaves and berries, suggests that UV-C merits further evaluation as either a stand-alone or complementary tool for GPM disease management.

Technical Session Abstracts

Use of Differential Thermal Analysis to Determine Grapevine Bud Hardiness on the Texas High Plains

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The grape (*Vitis vinifera*) and wine industry has an economic impact of over $20 billion within the state of Texas. Currently there are more than 3,700 ha of vineyards within the state, and greater than 80% of Texas vineyards are located in the High Plains American Viticultural Area (AVA). During the dormant season extreme temperatures (cold and warm) within the High Plains AVA often impose challenges for grape buds acclimating in the fall and deacclimating in the spring. To assist growers assess grapevine bud hardiness, during winters of 2021 – 2022 and 2023 – 2024 differential thermal analysis (DTA) was used to evaluate bud hardiness of seven cultivars ('Albariño', 'Vermentino', 'Viognier', 'Cabernet Sauvignon', 'Carignan' 'Petite Sirah', and 'Touriga Nacional'). Mean daily air temperature minimum for the 2021 – 2022 winter / early spring was colder when compared to mean daily air temperature minimum for the 2023 – 2024 winter / early spring. DTA low temperature exotherm data each year indicate 'Viognier', 'Carignan', and 'Touriga Nacional' buds had greatest cold hardiness, while 'Vermentino', 'Petite Sirah', and 'Cabernet Sauvignon' buds where the least cold hardy. In addition, more mild temperatures during 2023 – 2024 likely induce grapevine buds to deacclimate sooner when compared to buds from the 2021 – 2022 winter. Furthermore, at no time during either winter / early spring season did minimum daily temperature drop below low temperature exotherm estimates for any cultivar. Continued yearly assessment of bud hardiness will assist High Plains AVA grape growers' management and planting decisions.

Surveying U.S Fresh-market Grape Consumers to Determine Key Attributes and Willingness to Pay

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Grapes (genus Vitis) have two subgenera, Vitis and Muscadinia. While Vitis (especially V. vinifera) is the backbone of the grape and wine industry, it can be challenging to grow in many U.S. states due to susceptibility to diseases. Current grape breeding efforts are focused on introgressing disease resistance from Muscadinia to Vitis and quality traits from Vitis to Muscadinia, resulting in new wide hybrid cultivars. In 2023, an online survey was distributed targeting U.S. consumers of fresh-market grapes to assess demographics, purchase habits/intent, and willingness-to-pay (WTP). Consumers for this survey were over 18-years, ¼ from each U.S. area (Southeast, Northeast, Northwest, Southwest), and had purchased grapes in last 12 months. There were 24 WTP choice sets (bunch grape, muscadine grape, or neither) with five price levels per pound ($2, $3, $4, $5, and $6), flavor (strong or mild), texture (soft or firm/crisp), size (small, medium, or large), seed presence (none or present), and color (purple/black, pink/red, or light/green). Consumers (n=950) were 51% female, age of 45, income of $95,000, and mostly white/Caucasian (86%). Consumers mostly purchased fruit from grocery stores (89%) with freshness, flavor, price, and seed presence as important attributes. Consumers were willing to pay more for muscadine grapes ($5.57), firm texture ($1.44), no seeds ($3.59) but less for pink/red color (-$0.94) or purple/black color (-$0.69). Results indicated a consumer demand for both bunch and muscadine grapes, preference for firm, green, seedless grapes, and tendency to purchase from traditional fruit purchasing channels.

Could We Use Grape Stems to Improve Red Wine Quality?

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Grape stems hold berries all together in a cluster and are either kept for pressing grapes to obtain a higher yield of juice or are kept during the practice known as whole clusters fermentation. Even though this technique is not commonly used, it has become increasingly popular for red wines to improve complexity, reduce alcoholic degree and improve texture. Marquette and Frontenac grape cultivars have been used in this study to evaluate the impact of the use of stems, either as whole clusters or as fresh stems, on the chemical and sensory properties of the respective red wines. 100% whole clusters (WC) were compared to 100% destemmed and crushed, and to 100% fresh stems (FS) added back to the must. Red wines were made following a standard procedure, and the wines were analyzed for basic chemistry, phenolic compounds content such as tannins and anthocyanins at bottling. The total phenolics and tannin concentrations in Marquette FS wine was higher than the CTL, and the tannin concentration of Frontenac WC wines was significantly higher than in FS and CTL wines. FS condition negatively impacted the color intensity of Frontenac wines, most likely due to the adsorption of anthocyanins on fresh stems leading to a color loss of Frontenac wines. The impact of those treatments on the chemical and sensory properties of the red wines after 6 months of aging will be discussed.

Impact of Yeast Strains on a Value Added Product Made from Grape Pomace

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Grape pomace is a waste product of the wine industry and is commonly used as compost, animal feed or dumped in landfills. About 20–30% of the fresh weight of the processed wine grapes is generated as grape pomace. It is estimated that for every 6 L of wine produced, about 1 kg of GP is generated and the estimated grape pomace production in the US was about 0.6 million of tons in 2017. In this study, the impact of three yeast strains on the quality of a value added product, "piquette", was evaluated. Grape pomaces, obtained after pressing of Marquette and Petite Pearl red wines, were soaked in water for 2 days, prior to being pressed. Cane sugar was added to the juices prior to inoculation with three yeasts strains (Cross evolution, ICV D254 and Exotics Mosaics). The piquettes were bottled before analysis and sensory evaluation by untrained panelists after 8 months aging. A higher concentration of glycerol in piquettes made from Exotics Mosaics yeast strains was observed in Petite Pearl pomace but not in Marquette, most likely due to different concentrations of fructose initially. Overall, piquettes made from 'Petite Pearl' pomace, especially made using ICV D254 yeast strain, were preferred by consumers most likely due to the pink color, carbonation and fruity flavors.

Thanks Ohio Grape Industries Committee!



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Student Poster Competition Abstracts

Haskap Variety and Winemaking Process Evaluations

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Haskap (*Lonicera caerulea*) plants are cold-hardy, with relatively novel berries that are of increasing interest to North American fruit winemaking. Berries from eleven haskap varieties (cv. Aurora, Boreal Beauty, Boreal Blizzard, Honey Bee, Indigo Gem, Kaido, Kawai, Keiko, Solo, Taka, Tana) were stored frozen, measured for winemaking chemical parameters (titratable acidity, malic acid, pH, soluble solid content, YAN, color, and total phenolics), fermented into wine using different winemaking protocols: 200 g berry micro lots and 13 kg berry macro lot fermentations comparing continuous submersion, punch down and accentuated cut edge (ACE) maceration regimes over 1, 2, and 5 d, with two different water amelioration levels (35%, and to 8 g/L titratable acidity) on the pressed juice must volumes. Total phenolic concentrations were measured and sensory analyses conducted to select and rank the intensity of attributes from sensorial differences in aroma, mouthfeel and taste on the whole fruit, pressed berry solids marc, and the finished wines to determine phenolic extraction by maceration regime. The use of ACE and continuous cap submerged wines from frozen haskaps resulted in higher pH, total phenolics, red color, tannin, bitterness, and astringency compared to other methods. These assessments will describe the selected commercially available haskap varieties and the effects of common winemaking process choices, characterizing their chemical and sensory impacts. They will also support approximating macro volume cellar technique results on laboratory microscale and stylistic winemaking decisions.

Exploring Genetic Associations of Anthocyanin and Phenolic Compounds in Cold Climate Wine Grape

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To ensure superior wine quality and enhanced health benefits, it is paramount to maintain the stability of anthocyanins and total phenolics in grapevines. These compounds not only impart rich color and robust flavor to wine but also contain antioxidants that are beneficial to human health. However, ensuring the stability of these compounds poses a significant challenge in North Dakota's harsh and variable climate. Deciphering the genetic control of these compounds is crucial for influencing the astringency, color, and mouthfeel of the wine. An incomplete diallel population of 1064 individuals were utilized to examine the genetic basis of total phenolic and anthocyanin composition key compounds that affect both the health benefits and the sensory attributes of wine. To understand the genetic variation responsible for these traits, a genome-wide association study (GWAS) was conducted using 24,000 SNP markers. The GWAS revealed six significant SNP associations on chromosomes 2, 5, 7, and 16 for anthocyanins, as well as three significant SNP associations for total phenolics on chromosomes 2, 6, and 11 over a period of two years. These findings will provide insights in understanding of the genetic factors affecting phenolic and flavonoid levels in wine grapes, offering a valuable resource for viticulture and enology, with potential applications in grapevine breeding for improved wine quality.

Effect of Location and Cultivar on Metabolomic Profile of Pennsylvania Red Wine Grapes

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Grape and wine chemistry are heavily dependent on grapevine environment, a phenomenon commonly known as "Terroir". Understanding grape and wine chemistry resulting from regional differences in environment can help grape growers maximize their production, improve wine quality, and sell more bottles, as unique flavor profiles attract novelty seeking consumers. Pennsylvania is a growing wine region, recently rising to 4th in the nation for wine production. Pennsylvania wine grapes remain understudied, however. This study aims to characterize the metabolomic profile of two cultivars of Pennsylvania wine grapes grown in different regions. Chambourcin (hybrid) and Cabernet Franc (*Vitis vinifera*) grapes were sampled from 4 locations across PA. Grape tissue was extracted using either 80% acetone or 14% ethanol. Extracts were analyzed by liquid chromatography-mass spectrometry. Principal-Component-Analysis (PCA) was performed, separating samples by global metabolomic profile. Additional experiments were performed to quantify wine-extractable tannins, which do not resolve well under standard chromatographic conditions. Microvinification was performed and tannin content was measured during and after fermentation. Grape extracted metabolites separated primarily by cultivar in PCA, with this dimension explaining 14.9% of the variance. PCA of each cultivar separated by location on dimension 2, which explained 11% of the variance. Wine tannin content ranged from 500-1250mg/L and 250-700mg/L in Cabernet Franc and Chambourcin, respectively, and showed strong location and cultivar differences. This research indicates that growing region is an important factor in PA grape and wine chemistry. Future work will describe the chemical and sensory attributes associated with PA growing regions.

Disease Identification and Management in Cold-hardy Interspecific Hybrid Grapevines

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Grapevine trunk diseases (GTDs) constitute a large disease complex of fungal pathogens known to affect the vascular tissue of several *Vitis* species across the world, most notably *Vitis* vinifera. Cold-hardy interspecific *Vitis* hybrids, bred for harsh winter climates, are beginning to show decline symptoms similar to GTDs, such as skipped spurs, dieback, and stunted development. However, unlike GTD in *Vitis* species, the underlying cause of trunk diseases in these cold-hardy interspecific hybrids remains unknown. In this study, we conducted a statewide survey in Iowa, where cold-hardy interspecific *Vitis* hybrids thrive, and identified several pathogenic fungi that could cause diseases in grapevines. In total, more than 400 isolates were obtained from diseased grapevines across different cultivars in various Iowa counties. Of these, 45 isolates represent unique taxa confirmed through ITS sequencing. Following Kochâs postulates, we verified the pathogenicity of *Alternaria* sp., *Fusarium* sp., and *Pestalotiopsis* sp., which are the most reoccurring genera isolated from diseased samples. This is worth noting, as none of these fungi are known to cause GTD in *V. vinifera*, suggesting unique causal agents of vine decline in cold-hardy interspecific *Vitis* hybrids. Field trials will be conducted to assess the effectiveness of the fungicides Cyprodinil and Fludioxonil, as well as other management strategies including pruning and wound treatments for disease control. Overall, our study has broad implications for grape growers, providing valuable insights into disease management practices specifically applicable to viticultural regions characterized by cold climates.

Student Poster Competition Abstracts

Early Seedling Growth Traits in a Diallel Population of Noir Cold Hardy Grapevines

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Little is known about grapevine seedling growth traits or how breeding parents influence these parameters. In this experiment, data was collected from 644 greenhouse grown seedlings of a half diallel population with selfs constructed using five noir grapevine parents (E.S. 10-18-58, 'Frontenac', 'King of the North', 'Marquette', and 'Sabrevois'). Height, above ground biomass, trunk caliper, total node number, and the specific node where the first tendril appeared were recorded 70 days after starting seeds. E.S. 10-18-58 produced the tallest seedlings on a mean basis; however, E.S. 10-18-58 was the only pistillate vine used as a parent in population development and as a result it had no selfed progeny. Grapes are reported to suffer from inbreeding depression; in this study there were varying degrees of growth reduction of selfs relative to outcrossed progeny, which was parent dependent. 'Frontenac' and 'King of the North' selfs suffered the least observed reductions in measures of height and biomass. In addition, 'Frontenac' did not show significant depression of caliper or total node number. 'Sabrevois' selfed progeny were the most affected by inbreeding; their height was reduced by 46% and biomass by 53% compared to outcrosses involving 'Sabrevois'. Following data collection, subsets of these seedlings were subsequently field planted for continued evaluation. On-going evaluation under Fargo, ND, USA field conditions will improve future understanding of correlations and potential (if any) for selection of growth characteristics at an early seedling stage to accelerate the grapevine breeding process.

Grapevine Cane Morphology is Heritable and Can be Altered by Selection

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Cultivated grapevines grow in conditions vastly different from wild grapevines. However, grapevine morphology is largely unaltered from the wild forms and represents a target for crop improvement. Cane morphology has far-reaching impacts on pruning, vineyard management, fruit quality, winter hardiness, and training systems. Despite the importance of cane morphology, the genetic basis of these traits is poorly understood and often overlooked in breeding programs. To determine if grapevine cane morphology can be improved through breeding, we investigated a half diallel population of noir grapevines grown together with parental lines in an augmented randomized complete block design. Parents included the regionally important genotypes; 'Marquette', 'King of the North', 'Frontenac', 'Sabrevois', and 'ES 10-18-58'. Canes including nodes 3-7 were collected in the winter of 2023-2024 and best linear unbiased estimates of average internode length, cane diameter, bud fresh and dry weight, and cold hardiness were determined. Then, half-diallel analysis was used to estimate the narrow-sense heritability of each trait. Traits were significantly affected by block, reflecting the sensitivity of grapevines to environmental conditions. However, heritability of physical parameters was high: narrow-sense heritability was 0.37 and 0.47 for internode length and diameter, respectively. These results demonstrate the genetic basis of these traits and suggest that selective breeding can be used to improve grapevine architecture for ease of management.

Supplemental Light Increases Stem Diameter, Foliage and Pruning Weights in *V. vinifera* cv. Cabernet Franc, cv. Chardonnay, and Hybrid cv. Chambourcin

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It typically takes 3-5 years for a bare-root, grafted grapevine to reach fruiting maturity in a vineyard. Meaning it can take years for a grower to recoup production from lost vines. A crucial condition for flower bud development is light intensity. The goal of this study was to evaluate supplemental light intensities for grapevine growth floral initiation of three grapevine cultivars: Chardonnay, Cabernet Franc, and Chamborcin. Three supplemental light intensities were evaluated for grapevine growth and floral development: 0, 300, and 600 PPFD. PPFD (Photosynthetic Photon Flux Density), measures how many micromoles of photosynthetic photons, 400-700 nm wavelength, are interacting with a surface, per square millimeter, per second. The supplemental light treatment lasted from April to September of 2023 in a randomized complete block design, 3 replicates per light treatment per cultivar. In November 2023, vines were evaluated for stem diameter, leaf area and pruning weights. Vines were moved into cold storage (4C) awaiting transplant to a commercial vineyard, April 2024. Stem diameter/pruning weights were higher in 300 and 600 PPFD, while average leaf area was lower in 300 and 600 PPFD treatments. Chardonnay showed an increase in stem diameter in 300-PPFD (14.37mm) compared to 0-PPFD (11.26mm), average leaf area of PPFD-0 (56.46cm3) was higher than PPFD-300 (42.82cm3) and PPFD-600 (43.19cm3). Results suggest that supplemental light promotes vine growth of young grapevines, a precursor to improved cluster development after transplanting. Cluster development will be reported as part of this poster presentation.



Poster Session Abstracts

Development and Field-deployment of a Novel Auxinic Herbicide Detection System

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To control proliferating glyphosate resistant weeds, row-crop farmers have increased reliance on pre-plant applications of auxinic herbicides (2,4-D, dicamba). Increased usage of 2,4-D/dicamba has also elevated the risk of off-site movement of these herbicides, commonly known as "herbicide drift." 2,4-D drift can damage grapevines, particularly where fields treated with 2,4-D are interspersed with vineyards. To date, there is no body of knowledge accurately quantifying and correlating real-time drift events with symptoms of vine injury, as many current detection methodologies are incapable of detecting auxinic residues in leaf tissues unless samples are collected shortly after the drift event. Here we present the development of a novel disc-based auxinic herbicide detection system. Concentration curve assays indicate that this system can quantify residues at concentrations as low as 3 billionths (2,4-D ester) or 3 trillionths (2,4-D amine) of a tank mix; or 3 millionths of a tank mix for dicamba. In field trials, detectors sprayed with a logarithmic concentration series of 2,4-D amine showed strong linearity of response ($R^2 = 1.0$). These discs were then deployed in commercial Ohio vineyards for two seasons (2022-2023) to quantify real-time drift events. Field-deployed detectors were able to successfully capture drift particles and allow quantification of auxinic herbicides in both growing seasons. From herbicide quantification data, "heat-maps" of drift intensity across the vineyard were generated showing herbicide drift patterns. These data indicate that this system can provide growers with a more robust tool for documenting and quantifying herbicide drift events.

Evaluating Use of Vine Shelters to Reduce Cold Injury in New Vineyard

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Vine shelters are widely utilized in Texas vineyards during the first two to three years following planting, offering protection from herbicide particle drift, herbivory, wind desiccation, and intense solar radiation. Although there are benefits of using vine shelters, due to their potential insulative properties coupled with inconsistent temperatures in Fall and Winter it is thought that some types may contribute to a delay and or disruption in acclimation and even promote de-acclimation during the dormant period, increasing the risk for cold injury. The goal of this study was to evaluate the insulative properties as well as light infiltration of 12 commercially available vine shelters. Loggers measuring temperature and lux were placed in the middle of each tube as well as a control, without vines, which measured ambient conditions over an entire year. Light transmittance (lux) ranged from 2% to 48% compared to ambient conditions. Furthermore, the annual mean temperature was elevated for 3 of the 12 shelters, with a maximum increase of 3% (X30) and reduced for 3 shelters when compared to ambient. Growing degree days (GDD) were also calculated with 6 shelters having up to 10% greater GDD accumulation compared to ambient and 2 with as much as 13% less accumulation. Finally, a spring frost event was recorded over an 8-hour period where 2 shelters maintained an increased temperature of 0.56C and 6 shelters an increase of 0.11C over ambient. This study proved temperatures within some vine shelter types differ from ambientthroughout the year confirming the need for a future study which will replicate the trial but with the addition of vines that will be directly monitored to evaluate vegetative growth indices and cold and heat injury measurements.

Foliar Potassium Fertilizer Increases Berry Sugars and Bud Cold Hardiness of *Vitis* sp. Chambourcin

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Potassium (K) has been claimed as a cryoprotectant to improve cold hardiness in grapevine. This study investigated the effect of foliar application of liquid-based potassium fertilizer, ReaX (0-0-25) on cold hardiness of *Vitis* sp. cultivar Chambourcin and its effect on yield and fruit quality. Grapevines were sprayed four to five times between fruit set and veraison at a concentration of 1.5% (v/v) for two seasons. Petioles were analyzed for nutrients at veraison, and yield components and fruit composition were collected at harvest. Bud cold hardiness was determined using differential thermal analysis and tissue browning. Potassium deficiency was observed in all treatments, and its concentration did not increase significantly in treated vines. However, berry K levels and total soluble solids increased in K-treated vines. There was no significant effect on yield or fruit basic chemistry. Significant differences in cold hardiness were observed during mid-winter in both seasons. It is suggested that foliar application of K could be used as a cultural practice to increase berry sugars and bud cold hardiness. Further studies are needed to confirm these findings with other cultivars.

Using Whole Genome Sequencing for the Identification of Wild *Vitus riparia* Clones

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From a collection of over 800 clones of wild *Vitus riparia* collected throughout southern Ontario, 11 selections were chosen for further rootstock testing. These 11 were also propagated to establish a mother garden for future use. Since these riparia clones were chosen for production potential (drought tolerance, salt tolerance, lime tolerance, robustness), ampelographic differences among them were few or very subtle. Whole genome sequencing (WGS) was proposed as a method of separating them by identifying genetic variants within each genome. Millions of variants were found even within the locally collected samples and sufficient variants may exist for differentiating different plants from the same selection. Selecting a set of variants unique to each clone for verification and for examining their contribution to clone-specific traits will be the next objective. This initial work presents WGS as a promising option for trueness-to-type testing of these riparia clones, as well as for the micro propagated grapevine material prior to field planting.

Poster Session Abstracts

Exploring Shifts in Wine Consumption and Purchasing Experiences Among Mid-Atlantic Consumers before, during, and after the Pandemic

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COVID-19 drastically changed alcohol purchasing, including frequency, volume, and retail-location. Our previous work found increased at-home wine consumption for mid-Atlantic consumers, with differences in purchases related to prior local wine experiences. Here, we explored which pandemic-related changes in behavior, opinion of PA wines, demographic and psychographic effects are still apparent today. Using an online survey of mid-Atlantic wine consumers (n=969), we collected consumption and purchasing habits before, during, and after the pandemic, and psychographic and demographic measures. Relative to pre-pandemic levels, out-of-home drinking and purchasing in-store have decreased, purchasing online has increased, and other avenues are unchanged. Subjective wine knowledge and household income are associated with increased likelihood to increase wine consumption post-pandemic. We ran virtual focus groups (n=26) where PA residents shared their shopping experience of a PA wine from a state-run wine store. They also shared about their behaviors during the pandemic, and beliefs about local wines. Participants reported difficulties finding dry PA wines, especially at a premium price. They enjoyed local winery visits or tastings and wanted to support local wineries. Although fewer people are partaking in social drinking occasions, most are interested in resuming this behavior, while some continue purchasing wine online, having started during the pandemic. This research suggests consumers have largely returned to pre-pandemic purchasing and drinking behaviors, except for decreased in-store sales. They like supporting local wineries but need an added experience as motivation.

Physical and Molecular Defenses that Contribute to *Vitis labrusca* Resistance to Japanese Beetles

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Grapevine (*Vitis*) is an important crop worldwide, but insect herbivory can be detrimental to yields. Thus, identifying physical and molecular characteristics that contribute to insect herbivory resistance can be beneficial to reduce losses. In this study, we evaluated the insect herbivory resistance of *Vitis labrusca* acc. 'GREM4' and Vitis vinifera cv. 'PN40024', two grapevine species with differing biotic stress tolerances, to Popillia japonica (Japanese beetle) herbivory. Both choice and no-choice feeding assays revealed significantly less leaf area was damaged by herbivory in 'GREM4' compared to 'PN40024'. We next tested the role of physical defenses, by investigating the effects of trichome density on insect herbivory resistance and found 'GREM4' possessed significantly higher leaf trichome density, which deterred insect herbivory. But even under equal trichome densities with 'PN40024', Japanese beetle feeding was still reduced in 'GREM4', so trichome density did not entirely explain the herbivory resistant phenotype. Finally, we carried out comparative molecular analyses of the gene transcripts and metabolites that were differentially accumulating in 'GREM4' under herbivory compared to 'PN40024'. We found genes involved in terpene biosynthesis and flavonoid biosynthesis were upregulated. The accumulation of terpene and flavonoid secondary metabolites, many of which had known insect herbivory defensive properties, in 'GREM4' compared to 'PN40024', further supported the genetic findings. These results can be leveraged to inform future breeding efforts and to develop sprayable products to deter herbivory.

Pruning Strategies when Using Geotextile as Winter Protection

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The use of geotextile covers is the method of choice to protect cold tender cultivars in Quebec, Canada. This project determined the impact of the timing and severity of pruning before geotextile installation on bud survival and yields. Five treatments were set up: full pruning (1) or pre-pruning (2) before leaf fall, full pruning (3) or pre-pruning (4) after leaf fall, and a control of pruning after geotextile removal (5). The experiment was repeated for the 2021–2022 and 2022–20223 winters on Chardonnay, Pinot noir, Seyval, Vidal in two vineyards per cultivars. Treatments were done on panels of 3–7 vines over four blocks in randomized complete block design.

Final pruning treatments led to higher % of bud damage and lower yields than the pre- pruning treatments, but only when the temperatures under the geotextiles dropped below -20 °C. No differences were recorded between the treatments applied before or after leaf abscission. No impact on phenology, periderm formation, or chemical composition of berries were recorded. Our conclusions are that pruning before leaf abscission does not have an impact in the short-term and could therefore be considered when waiting is not possible. Pre-pruning before geotextile installation is the best strategy in case of extreme cold temperatures during the winter. It is important to note that aggressive pruning before the installation of geotextile fabric may prevent the use of delayed pruning technique against spring frosts. Leaving enough buds during pre-pruning is therefore something to consider for particularly frost-prone sites.



Poster Session Abstracts

eDNA Collection Case Study for Spotted Lanternfly in Cleveland, Ohio
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Spotted Lanternflies (SLF) is an invasive insect species rapidly colonizing Northeast and Midwest USA. This pest readily infests woodlots, vineyards, parks, and other natural areas. SLF excrete honeydew which not only attracts wasps and bees, but honeydew also creates sooty mold on plants. This not only creates hazards, but a nuisance for communities. As SLF spreads across the USA, monitoring this species is crucial in attempts to control increasing populations. As we monitor the spread of SLF, environmental DNA (eDNA) detection, can further understanding where SLF are spreading and how early we can detect SLF. Understanding the relationship of these factors to the detection of SLF using the eDNA method can help us better detect and eliminate these pests. We hypothesize eDNA will outperform in person, visual scouting. To test this, we sampled during the years 2022 and 2023, where we collected eDNA samples from Cleveland, a recently infested city in Ohio. To collect eDNA, we used paint rollers that were sprayed with water and were rolled on randomly selected surrounding trees. The water was filtered using membrane filters and later extracted using DNA extraction solutions. Samples were analyzed using real time polymerase chain reaction. Results showed eDNA significantly outperformed visual detection. This suggests eDNA is promising method to pair with visual detection where there are low populations of SLF. This can be especially helpful in locations that are at-risk such as vineyards. In addition, we have paired the method to monitor vineyards across NE and NW Ohio.

Pinot Noir Clones Differ in Response to Early Leaf Removal (ELR) Treatment
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Although there exists a substantial body of knowledge on the general effects of Early Leaf Removal (ELR) on tight clustered varieties, there is relatively little clone-specific guidance. A trial was conducted in 2019 and 2020 at the Ashtabula Agricultural Research Station (AARS) in Kingsville, OH to determine the efficacy and relative sensitivity to ELR of four commercially significant Vitis vinifera L. Pinot Noir clones (Dijon 777, Dijon 115, Pommard, and Mariafeld). Leaf removal at trace bloom (E-L 19) and fruit set (E-L 27) were applied to vines in a completely randomized design. Yield, cluster number, berry number, and rot severity were measured in 2019 and 2020, in addition to juice parameters such as total soluble solids (°Brix), titratable acidity (TA), pH, and total phenolics (Folin-Ciocalteu Method). ELR treatment demonstrated significant effects on the brix, pH, TA, yield, and rot severity of the Mariafeld clone at AARS. Impacts of ELR on the other three clones were notably inconsistent across the spectrum of measured parameters. Further investigation should test the performance of the Mariafeld clone at diverse locations. Possible relational links may be sought for a genetic basis for the tendency of the Mariafeld clone to produce loose clusters and its observed sensitivity to ELR treatment.

Evaluating the Performance of Camminare Noir in Texas
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Camminare Noir is a new Pierce's Disease resistant red wine grape cultivar released by the University of California Davis in 2019. Early observations of this grape in the Texas Gulf Coast and Hill Country suggest that uneven ripening within and across clusters may be a challenge. To better understand this problem, data was collected on an individual vine basis at five commercial vineyards across the Texas Gulf Coast to characterize canopy density and cluster microclimate, yield components, and crop load. At harvest fruit from vines with denser canopies, more cluster shading, and lower crop loads generally had lower soluble solids, total anthocyanins, and tannins. A > 2.7-fold difference in tannins and > 7-fold difference in total anthocyanins was observed across sites. This study suggests that Camminare Noir may require careful canopy and crop management to maximize fruit quality, particularly on vigorous sites.

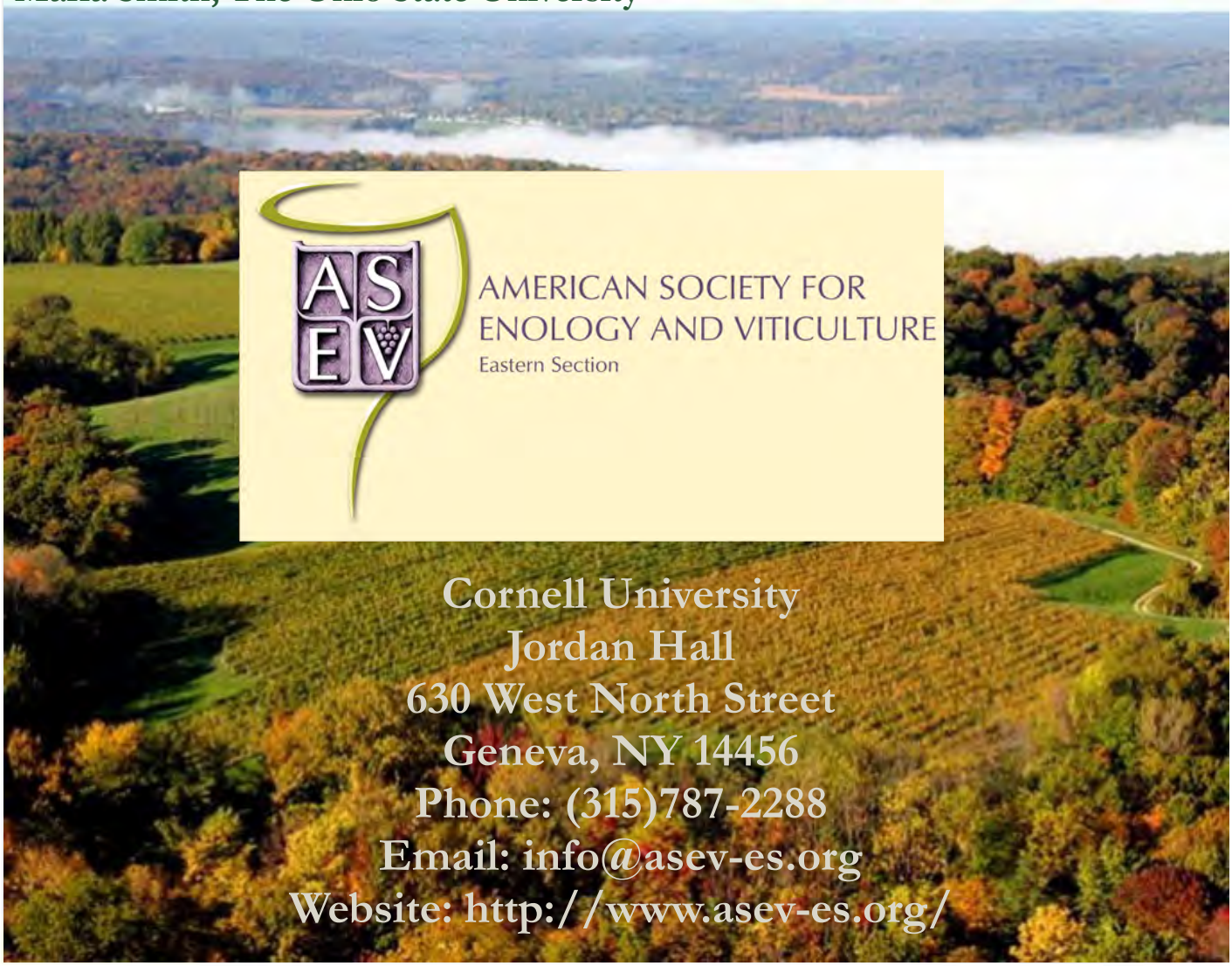


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