



American Society for Enology and Viticulture- Eastern Section

46th ASEV-Eastern Section
Annual Meeting
Bloomington, Minnesota
July 13-15, 2022

Workshop
Resiliency in Grape and Wine Production



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

Conference Overview

Conference Events: Hilton Minneapolis/Bloomington

Hilton Minneapolis/Bloomington (3900 American Blvd West, Bloomington, MN 55437)

Wednesday, July 13, 2022

Conference Registration	Foyer A	7:00-7:45 am
Tour Minnesota Vineyards & Wineries	Lobby	7:45 am-5:15 pm
ASEV-ES Board Meeting/Dinner	Location Offsite	7:00-9:00 pm

Thursday, July 14, 2022

Conference Registration	Foyer A	7:30 am-5:00 pm
Welcome and Overview	American Salon A	8:00-8:30 am
Distinguished Service Award	American Salon A	8:30-9:00 am
Student Poster Flash Talks	American Salon A	9:00-9:30 am
<i>Break/View Posters</i>	American Salon A	9:30-10:00 am
Technical Sessions	American Salon A	10:00-11:00 am
Student Presentation Competition	American Salon A	11:00 am-12:00 pm
Lunch and ASEV-ES Business Meeting	American Salon B/C	12:00-1:30 pm
Student Presentation Competition	American Salon A	1:30-2:30 pm
Poster Flash Talks	American Salon A	2:30-3:00 pm
<i>Break/View Posters</i>	American Salon A	3:00-3:30 pm
Technical Sessions	American Salon A	3:30-5:00 pm
View Posters	American Salon A	5:00-5:30 pm
Oenolympics & Wines of East Reception	American Salon B/C	5:30-7:00 pm

Friday, July 15, 2022

Conference Registration	Foyer A	7:30 am-2:00 pm
Welcome and Announcements	American Salon A	8:00-8:15 am
Outstanding Achievement Award	American Salon A	8:15-9:00 am
Technical Sessions	American Salon A	9:00-10:00 am
<i>Break/View Posters</i>	American Salon A	10:00-10:30 am
Technical Sessions	American Salon A	10:30-11:30 am
Lunch	Own Your Own	11:30 am-1:00 pm
Resiliency in Grape and Wine Production	American Salon A	1:00-6:00 pm
Grand Awards Reception and Banquet	American Salon B/C	6:30-8:30 pm

ASEV-ES Conference Sponsors

(Sponsors are recognized throughout the program.)

Wednesday, July 13, 2022

Tour Minnesota Vineyards & Wineries

Tour Coordinators: Matthew Clark, Drew Horton, and Annie Klodd, University of Minnesota and Lisa Smiley, Cannon Valley Vineyards

Meet in Hilton Minneapolis/Bloomington Lobby 7:45 am

Depart for Brickhaven Vineyards 8:00 am
Vineyard Tour 8:45-9:45 am

Depart for Chankaska Creek Ranch, Winery & Distillery 9:45 am
Vineyard and Winery Tour 10:30-11:30 am
Wine Tasting and Purchases 11:30 am-12:00 pm

Depart for Winery at Sovereign 12:00 pm
Lunch with Wine Tasting and Purchase Wines 1:00-2:30 pm
Vineyard and Winery Tour 2:30-3:00 pm

Depart for University of Minnesota Horticultural Research Center 3:00 pm
Research Center Tour 3:30-4:45 pm

Depart for Hilton Minneapolis/Bloomington 4:45 pm

Arrive at Hilton Minneapolis/Bloomington 5:15 pm



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UNIVERSITY OF MINNESOTA EXTENSION



SOVEREIGN
E S T A T E

Thursday, July 14, 2022

Welcome

8:00-8:15 am

Moderators: Jim Willwerth, Brock University and ASEV-ES Chair & Mark Hoffmann, North Carolina State University and ASEV-ES Chair Elect

Overview of Enology and Viticulture in Minnesota

8:15-8:30 am

Annie Klodd and Drew Horton, University of Minnesota

ASEV-ES Distinguished Service Award

8:30-9:00 am

Elevating the Growing Ohio Wine Industry Through Enhanced Extension Efforts

Todd Steiner, Ohio State University

Student Poster Flash Talks (3 minutes each)

9:00-9:30 am

Association Study of Cold Hardiness in Interspecific Wine Grapes (*Vitis* spp.)

Ramesh Pilli*, Venkateswara Kadium, Andrej Svyantek, Avery Shikanai, Xuehui Li, and Harlene Hatterman-Valenti

Sampling Missouri Vineyards- A Weed Survey

Michelle M. Maile, Dean S. Volenberg*, and Reid J. Smeda

Impact of Post-Fruit Set Leaf Removal on Marquette Grape Chemistry During Development and Ripening

Yiliang Cheng, Lucas Buren, Gail Nonnecke, and Aude A. Watrelot*

Effect of Whole Cluster Fermentation on Phenolics and Sensory Perception of Marquette Wines

Alexander D. Gapinski, Andrew Horton, and Aude A. Watrelot*

The Efficacy of Mushroom-Derived Chitosan as a Fining Agent for Sparkling Wine Juice

Jacob Medeiros, Gary Pickering, and Belinda Kemp*

Effect of Maceration and Post-Maceration Enzyme Additions on Tannin Concentration in Hybrid Wines

Samuel Ziegler*, Misha Kwasniewski, Helene Hopfer, and Joshua D. Lambert

Survey of Wine Purchasing and Consumption Habits of Consumers of Commercial Arkansas Wines

Amanda J. Fleming and Renee T. Threlfall*

Break/View Posters

9:30-10:00 am

Technical Sessions (20 minutes each)

10:00-11:00 am

The Climate, Soils and Phenology of New Mexico Vineyards

W. Gill Giese*, Michael Leonardelli, and Ciro Velasco-Cruz

A Wine Industry Dilemma: Does Crop Size Reduction Make Better Wine?

Paul E. Read*, Benjamin A. Loseke, and Stephen J. Gamet

What's "Vinifera-like"? Consumer Perception of Hybrid Red Wine Color

Anna Katharine Mansfield* and Catherine H. Dadmun

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

Sensory Impact of New York Hardwoods on Aged New York Wines

Jennifer M. Neubauer, Peter J. Smallidge, and Anna Katharine Mansfield*

Reductive Off-Aroma in Canned Wines – Compositional Factors Related to H₂S Formation

Matthew Sheehan, Austin Montgomery, Rachel Allison, and Gavin Sacks*

Optimizing Microvinification for Determining Aroma, Smoke Taint and Phenolic Extraction in Wine

Ezekiel R. Warren and Misha T. Kwasniewski*

Using *Lachancea thermotolerans* Yeast to Modify Acidity in Wine Fermentations from Chambourcin Grapes Grown in Arkansas

Amanda J. Fleming and Renee T. Threlfall*

Lunch and ASEV-ES Annual Business Meeting 12:00-1:30 pm

Student Oral Presentation Competition (15 minutes each) 1:30-2:30 pm

Maillard Reaction-associated Compounds and Changes in Amino Acid Profile during Sparkling Wine Ageing
Hannah M. Charnock, Gary Pickering, and Belinda S. Kemp*

Synergetic Effect of Accentuated Cut Edges (ACE) and Macerating Enzymes on Marquette Wine Quality
Yiliang Cheng and Aude A. Watrelot*

Improving Frost Mitigation with Abscisic Acid Analogs—Influence on Grapevine Bud Cold Tolerance and Dormancy Status
Alexandra Gunn and James J. Willwerth*

Precise Indoor Vine Conditioning: Impact of Supplemental Light Intensity on the Physiology of 'Traminette' and 'Concord' Grapevines
Kyle Freedman*, Cristian Collado, Sara Spayd, Ricardo Hernández, and Mark Hoffmann

Poster Flash Talks (3 minutes each) 2:30-3:00 pm

Evaluating Foliar Fertilization for Enhanced Cold Hardiness and Fruit Quality
Andrej W. Svyantek, Avery K. Shikanai, Collin P. Auwarter, and Harlene M. Hatterman-Valenti*

Entomopathogenic Nematodes as an Alternative Management Strategy for Grape Root Borer
Clark MacAllister*, Brett Blaauw, Nathan Eason, and David Shapiro-Ilan

Impact of Grapevine Leafroll-associated Virus-3 and Grapevine Red Blotch Virus on Yield and Berry Juice Quality in the American Grape Norton
Cooper R. Adams, Harper F. LaFond, Zhiwei D. Fang, Christine Spinka, Dean S. Volenberg*, and James E. Scholz

Efficacy of Selected Fungicides for the Control of Pestalotiopsis spp. Causing Grape Berry Rot
Dean S. Volenberg*, Brogan R. Eyre, Zhiwei D. Fang, and Harper F. LaFond

Acidity Modification in Wine Fermentations from Arkansas-grown Chambourcin Grapes Using Non-Saccharomyces Yeast
Amanda J. Fleming and Renee T. Threlfall*

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

Technical Sessions (20 minutes each) 3:30-5:00 pm

Indulgence and Dazzle Wine Grapes for the Mid-South (Includes Tasting)
Renee T. Threlfall*, John R. Clark, and Margaret L. Worthington

Consumer Liking, Interest and Willingness to Pay for Vidal and Marquette Table Wines
Amy J. Bowen*, Amy Blake, and Jennifer Kelly

Focus on Texas Wine - A Consumer Perspective
Andreea Botezatu*

Evaluation of New Wine and Table Grape Cultivars in Texas
Justin J. Scheiner* and Fran Pontash

View Posters 5:00-5:30 pm

Adjourn 5:30 pm

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

Friday, July 15, 2022

Welcome and Announcements

8:00-8:15 am

Moderators: Jim Willwerth, Brock University and ASEV-ES Chair & Mark Hoffmann, North Carolina State University and ASEV-ES Chair Elect

ASEV-ES Outstanding Achievement Awards

8:15-9:00 am

It Takes a Village: Refection's on a Career in Viticulture and Enology (virtual presentation)

Sara Spayd, North Carolina State University

Breeding Resilient, Resistant Grapes: 1980 to present (virtual presentation)

Bruce Reisch, Cornell University

Technical Sessions (20 minutes each)

9:00-10:00 am

The North Dakota State University Grapevine Variety Trial: A Stable of Cold-Hardy Grapevines, but Are Any Grapevines Stable?

Andrej Svyantek, John Stenger, Bülent Köse, Collin Auwarter, and Harlene Hatterman-Valenti*

Establishment of a Bud Hardiness Monitoring Program in Québec, Canada

Andréanne Hébert-Haché*, Alexander Campbell, and Caroline Provost

Developing a Cold Climate Grape Extension Program in the Upper Midwest

Annie Klodd*, Amaya Atucha, Matt Clark, Christelle Guedot, Leslie Holland, and Josie Russo

Break/View Posters

10:00-10:30 am

Technical Sessions (20 minutes each)

10:30-11:30 am

How Does the Quality of Cold-Hardy Hybrid Red Wines Change Over Time?

Carmen Vavra, Yiliang Cheng, Alexander Gapinski, and Aude A. Watrelot*

Resources in USDA Cold-Hardy Germplasm: What We Have and What We're Working On

Erin R. Galarneau* and Ben L. Gutierrez

Survey of the USDA Cold-Hardy Germplasm for Grapevine Trunk Diseases

Daniel J. Meyers and Erin R. Galarneau*

Lunch Own Your Own

11:30 am-1:00 pm

**Sponsor of Best Student
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Industry Workshop

1:00-5:00 pm

Resiliency in Grape and Wine Production

Presentations, Interactive Discussions, and Tastings

This workshop addresses the extreme challenges in U.S. grape and wine production and possible solutions for our industry with keynote speakers.

Welcome and Introductions

1:00-1:10 pm

Moderator: Matt hew Clark, University of Minnesota and ASEV-ES Board Member

Breeding and Genetics

1:10-1:30 pm

Matt Clark, University of Minnesota

Viticulture

1:30-2:15 pm

Cain Hickey, Penn State and Maria Smith, Ohio State University

Enology

2:15-3:00 pm

John Taylor, Chankaska Creek Ranch, Winery, & Distillery

Break/View Posters

3:00-3:30 pm

Grape and Wine Marketing (Includes Tasting)

3:30-4:15 pm

Haley Brown, Wine Growers Nova Scotia
Jean-Benoit Deslauriers, Benjamin Bridge

Resources Beyond Extension

4:15-5:00 pm

Fritz Westover, Westover Vineyard Advising, LLC

Panel Session

5:00-6:00 pm

Adjourn

6:00 pm

ASEV-ES Grand Awards Reception and Banquet

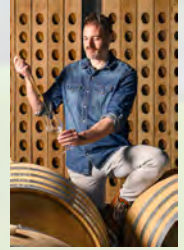
6:30-8:30 pm

**Donation of Wine Glasses for ASEV-ES
Banquet**

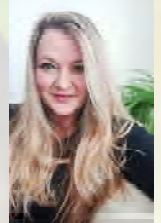
ARTON
PRODUCTS

Workshop Speakers

Jean-Benoit Deslauriers is the head winemaker for Benjamin Bridge located in Nova Scotia. He joined the team in the spring of 2008 and has more than two decades of experience in the wine industry, including 16 years in winemaking. From his start with Casa Barranca, Santa Barbara County's very first certified organic winery, to VINO Organico Emiliana, one of South America's early certified biodynamic pioneers, Jean-Benoit's body of work has exclusively helped the growth and progress of sustainable and ethical operations. In order to assist Benjamin Bridge in releasing products that are unique and ahead of their time, Jean-Benoit's primary focus remains the ongoing evolution of wine as a cofactor of our evolution as a biosphere and society.



Haley Brown is the Executive Director of Wine Growers Nova Scotia. She is an accomplished marketing and stakeholder relations executive with over 20 years experience in building strategic partnerships for diverse global and national clients both in the private and the public sectors. In the early part of her career she worked as Marketing Manager in Europe and Asia for a UK based resort developer and operator and had operational and communications roles with the Calgary Flames, and the London (UK) Skolars Rugby Club. More recently she was the Special Advisor and Press Secretary to a Province of Alberta Cabinet Minister and was Senior Project Manager for Telus in Vancouver and Calgary; as well, has consulted for a number of tech startups on how to position their brands internationally.



Dr. Matthew Clark

Dr. Matt Clark is an Associate Professor of grape breeding and enology at the University of Minnesota. His focus is on developing coldy-hardy and disease resistant grapes for wine production as well as for fresh eating. His lab has been studying the genetic control of resistance to phylloxera, an insect pest that affects native grape leaves. Through the VitisGen2 project, he has incorporated routine marker-assisted selection using DNA testing to screen plants for important traits of interest.



Dr. Cain Hickey is the statewide Viticulture Extension Educator at Penn State. He has been engaged in viticulture research and extension since 2007. Cain has presented at state, regional, national, and international academic and industry conferences, and developed and coordinated numerous extension workshops. He co-coordinates the Eastern Viticulture and Enology Forum webinar series. Cain has authored peer-reviewed journal articles, extension publications, facts sheets, and trade publications. His research has an applied viticulture emphasis, and has recently been focused on pruning, training, and canopy management. Cain works with the Pennsylvania grape and wine industry to solve vineyard management issues and optimize grape production practices.



Dr. Maria Smith is a Viticulture Extension Specialist at The Ohio State University (OSU), CFAES-Wooster Campus where she delivers state-wide extension programming to the Ohio commercial wine grape industry. In addition to her extension responsibilities, she also assists with OSU research efforts related to new variety evaluation, vineyard canopy management, grapevine winter injury, and herbicide drift injury. Prior to joining OSU in 2018, Dr. Smith earned her PhD in viticulture at The Pennsylvania State University. At Penn State, her research focused on the impact of vine selection on spring frost recovery and the use of novel canopy management practices for yield regulation, wine quality, and vine health in *Vitis vinifera* and *Vitis* hybrid wine grape varieties. Additionally, she holds a B.S. in biology from Virginia Commonwealth University and an M.S. in horticulture from Cornell University.



John Taylor is the Vice President of Operations, Head Winemaker and Distiller for Chankaska Creek Ranch, Winery and Distillery. His 20 year career takes several twists and turns on the road to Minnesota. A native Californian, John grew up with wine as a part of everyday life. He worked with Cool Climate grapes while finishing his Bachelor of Science from Cal Poly Concentrating in Enology and then spent 3 years with E & J Gallo Winery learning not only the art and science of wine, but logistics and production efficiency. Additionally in California, he has spent 3 years co-managing a vineyard and crafting Estate products in Paso Robles. He has had the good fortune to work with winemakers the likes of Randall Graham, Alison Crowe, Mike Sinor, Mike Drash, Josie Boyle and many others. John has been in Minnesota making wine since 2017 and with Chankaska since 2018.



Fritz Westover is Viticulturist and owner of Westover Vineyard Advising, based in Houston, Texas. Westover obtained his BS in Horticulture and MS in Plant Pathology from Penn State University, where he worked on projects including grapevine decline, grape disease management, and the science of compost application in vineyards. He specializes in vineyard consulting for over 1,500 acres of vineyard and is active in research and education in the south and southeastern United States, drawing from more than 15 years experience in the vineyard industry including extension and outreach positions in Virginia, Texas, and California. Westover contributes to wine industry educational programs in several states and is founder of Virtual Viticulture Academy, a leading resource for practical grape growing information for all levels of winegrape production.



2022 ASEV-ES Outstanding Achievement Awards

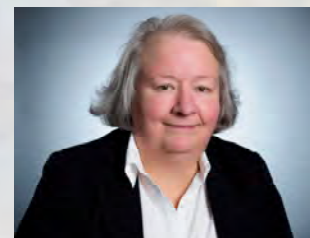
Dr. Bruce Reisch Professor, Cornell University

Dr. Reisch specializes in the development of new wine and table grape varieties, as well as modern grape breeding techniques using the tools of genomics, at Cornell AgriTech, the New York State Agricultural Experiment Station in Geneva, NY. Since joining the Cornell faculty, his program has released 14 new wine and table grape varieties. Disease resistance is a high priority, along with low temperature tolerance and fruit quality, leading to viticultural sustainability and resilience. In addition to his research responsibilities, Dr. Reisch chaired the Grape Crop Germplasm Committee for over 10 years, a national committee advising the U.S. Department of Agriculture efforts to preserve wild and cultivated grapevines. He currently co-leads the “VitisGen2” project <www.vitisgen2.org> to apply next-generation DNA sequencing tools to grape breeding programs across the United States. His studies have taken him to conferences and research stations in Australia, Chile, France, Italy, Germany, Portugal, Israel, Hungary, Turkey, China, Thailand, Taiwan and Japan. Dr. Reisch has also enjoyed teaching courses in Grapevine Biology, Viticulture, Genetic Improvement of Crop Plants, and general Plant Genetics.



Dr. Sara Spayd Professor Emeritus, North Carolina State University

Dr. Sara Spayd is a Professor Emeritus from North Carolina State University. At the University of Arkansas, Dr. Spayd earned an MS in 1977 followed by a PhD in 1980; both degrees in Food Science focusing on viticulture and enology. Following graduation, Dr. Spayd became the Extension Food Scientist (Enology) for Washington State University. Dr. Spayd retired from Washington State and accepted a position as Extension Viticulture Specialist/Professor at North Carolina State University where she was involved in supporting grape growers through teaching, research, and extension efforts. Dr. Spayd was active in her professional society, the American Society of Enology and Viticulture, where she held many elected and volunteer positions. Her research was recognized with the 1994, 2002, and 2009 American Journal of Enology and Viticulture Best Viticulture Paper Award. In recognition of a highly successful career, Dr. Spayd was awarded the 2019 Merit Award by the American Society of Enology and Viticulture. During her academic, research, and extension career from 1980 to 2016), Dr. Spayd received \$5.8 million dollars in grant funds and published over 926 referred articles.



2022 ASEV-ES Distinguished Service Award

Todd Steiner Enology Program Manager and Outreach Specialist, Ohio State University

Todd Steiner has been with The Ohio State University/OARDC 33 years and has been the leader of the Enology program since 2001. Todd received a B.A. in Biology from Tabor College in Hillsboro, Kansas. He went on to specialize in enology under the direction of Dr. Jim Gallander at The Ohio State University/OARDC. He serves as the state Enologist to the Ohio commercial wine industry. Due to the rapidly growing Ohio commercial wine industry, Todd has moved to a full extension appointment under the Ohio Grape Industries Committee and The Ohio State University. His extension responsibilities include co-organizing the annual Ohio Grape and Wine Conference, the annual Ohio Wine Competition, organizing workshops and being a featured presenter at both in-state and out-of-state meetings. Winery consultation is an especially important aspect of his responsibilities in extension. He is also responsible for initializing a wine analysis program in working with quality control and troubleshooting for the Ohio commercial wine industry. Todd has helped develop the groundwork for the Ohio Quality Wine Program (OQW) that started with wines being evaluated in 2007. Recently, he has developed several large programmatic efforts in addition to writing a wine production guide to answer the growing wine industry in Ohio. Todd has been honored in being asked to judge in numerous regional, national, and international wine competitions within the United States. He has devoted many years to serving the American Society of Enology and Viticulture – Eastern Section (ASEV-ES) in different capacities and as a professional member since the late ninety’s during his enology career. Todd has also served several terms on the ASEV-ES Board of Directors.



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.

AMERICAN SOCIETY FOR ENOLOGY AND VITICULTURE



Established 1975

2022 ASEV-ES Scholarship Recipients



Hannah Charnock, Brock University

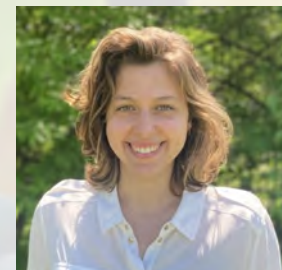
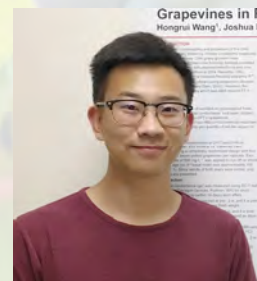
Kyle Freedman, North Carolina State University

Glycine Jiang, Cornell University

Demetra Perry, Cornell University

Meredith Persico, Penn State University

Hongrui Wang, Cornell University



2022 Scholarship Fundraiser Raised over \$10,000

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 donor for your contributions.

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

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Fritz Westover (Silver Donor)
William Edinger (Bronze Donor)

Student Presentation Competition Abstracts

Abstracts ordered alphabetically by last name of presenting author in bold

Maillard Reaction-associated Compounds and Changes in Amino Acid Profile during Sparkling Wine Ageing

Hannah M. Charnock, Gary Pickering, and Belinda S. Kemp*

*Corresponding author: Cool Climate Oenology and Viticulture Institute (CCOVI), Department of Biology, Faculty of Math & Science, Brock University, St. Catharines, ON, L2S 3A1, Canada, bkemp@brocku.ca

The Maillard Reaction (MR) is a non-enzymatic multi-step reaction involving reducing sugars and amino acids, producing volatile and flavour-active compounds. In aged sparkling wine, MR-associated products including furans, heterocycles, pyrazines, and thiazoles have been identified and contribute nutty, caramel, and roasted aromas. Liqueur de dosage (composed of sugar, wine, and SO₂) is a final sugar addition made post-disgorgement at the end of the production process. Sugars in dosage degrade or interact with amino acids in the formation of MR-associated products during sparkling wine ageing. The aim of this study was to evaluate the influence of six sugar-types used in liqueur de dosage (glucose, fructose, sucrose (cane-derived), sucrose (beet-derived), maltose, rectified concentrated grape must) on the composition of amino acids and MR compounds in sparkling wine over 18-months bottle ageing. All treatments were carried out in traditional method sparkling wine (2015 vintage, 3 years lees ageing; 59% Chardonnay, 41% Pinot Noir) and compared to zero-dosage wines (no sugar addition). Three bottles of each treatment were collected at 0, 9, and 18 months and analyzed in duplicate. Amino acid content was determined by quantitative nuclear magnetic resonance spectroscopy, and MR products were quantified by headspace solid-phase microextraction coupled to gas-chromatography mass-spectrometry. Results show that concentrations of amino acids and MR products differ depending on ageing duration and dosage sugar-type, likely due to their involvement in the MR pathway and/or degradation. This study establishes the effect of dosage sugar-type on MR products and amino acid precursors in sparkling wines during 18-months of ageing.

Synergetic Effect of Accentuated Cut Edges (ACE) and Macerating Enzymes on Marquette Wine Quality

Yiliang Cheng and Aude A. Watrelot*

*Corresponding author: Iowa State University, Department of Food Science and Human Nutrition, Food Sciences Building, 536 Farm House Lane, Ames, IA 50011, USA, watrelot@iastate.edu

The binding affinity between tannins and cell wall material is thought to be one of the reasons for low tannin extractability and high tannin retention during red winemaking from cold-hardy interspecific grapes. This study focused on using Accentuated Cut Edges (ACE) technique in combination with macerating enzymes to improve phenolics extraction during the winemaking process of the Marquette grape cultivar. At crushing, Marquette musts were processed with ACE followed by enzymes and compared to a control and an ACE-control without enzymes. Iron-reactive phenolics (IRP), polymeric pigments, and color characteristics as well as anthocyanins, flavan-3-ols, and tannin contents were quantified by HPLC-DAD/FLD in wines at bottling and after 6-months of aging. Wine polysaccharides were quantified by HPLC-DAD after acid-hydrolysis and derivatization. The contents of flavan-3-ols, tannins, IRPs, and polymeric pigments were higher in combined ACE and enzyme treated wines than in ACE and control wines. ACE- treated wines showed significantly higher flavan-3-ols concentrations than the control. Only ACE combined with macerating enzymes caused an increase in rhamnose and galacturonic acid content and a decrease in arabinose content compared to ACE and control wines. The results suggested that ACE treatment promoted the release of phenolics due to the intensified breakdown of grape skins, while it had no impact on the polysaccharide composition. Our study exhibited a potential winemaking strategy to improve phenolics content in cold-hardy red wines through the synergetic effect of ACE and macerating enzymes, which may facilitate the extraction and modulate the retention of tannin during winemaking.

Using *Lachancea thermotolerans* Yeast to Modify Acidity in Wine Fermentations from Chambourcin Grapes Grown in Arkansas

Amanda J. Fleming and Renee T. Threlfall*

*Corresponding author: University of Arkansas, Department of Food Science, 2650 N. Young Avenue, Fayetteville, AR 72704, USA, rthrelf@uark.edu

The use of non-Saccharomyces yeasts to modify acidity and other characteristics of wines during fermentation has increased commercially. Chambourcin (*Vitis hybrid*) red wine grapes were harvested in 2021 from a commercial vineyard in Arkansas, randomized into eight batches (four fermentation treatments in duplicate), crushed, and destemmed. Treatments included two fermentations with *S. cerevisiae* (SC) with and without malolactic fermentation (MLF) and two fermentations with *Lachancea thermotolerans* (LT) followed by a sequential inoculation of *S. cerevisiae* (LT-SC) with and without MLF. Basic composition, sugars, and organic acids of must/wine were evaluated daily during fermentation (0-14 days at 21°C). Prior to inoculation, the must had 21.00% soluble solids, 3.51 pH, 0.73% titratable acidity (TA), 18.78% total sugars, and 0.81% total organic acids with primary acids as tartaric (0.31%) and malic (0.44%). All wines completed fermentation (<0.3% total sugars) at six days resulting in ~10% ethanol. Regardless of MLF at day 14, the TA (1.29-1.33%), lactic acid (0.67-0.70%), and total organic acids (1.43-1.45%) of LT-SC wines were higher than SC wines, while pH was lower (3.35). From day 0 to 14, SC-MLF treatments had the greatest reduction (40%) in malic acid compared to SC (1%), LT-SC (7%), and LT-SC-MLF (10%) treatments while LT-SC and LT-SC-MLF treatments had a 5% reduction in pH. Additionally, lactic acid production was 0.04% for SC, 40% for SC-MLF, 67% for LT-SC-MLF, and 70% for LT-SC. Increases in lactic acid using *L. thermotolerans* with or without malolactic fermentation broadens options to achieve smoother, more complex wines with improved stability.

ASEV-ES Conference Planning in Minnesota

Matthew Clark, Drew Horton, and Annie Klodd, University of Minnesota and Lisa Smiley, Cannon Valley Vineyards

Student Presentation Competition Abstracts

Precise Indoor Vine Conditioning: Impact of Supplemental Light Intensity on the Physiology of 'Traminette' and 'Concord' Grapevines

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Perennial fruits such as grapes take up to 5 years to produce harvestable yields and require high up-front costs. Prior research has shown that high light intensity and temperature can increase grapevine flowering and thus potential yield. Advances in Controlled Environment Agriculture (CEA) and more efficient lighting technologies such as Light Emitting Diodes (LED) can be utilized to condition young grapevine transplants for increased yields. We hypothesize that such conditioned green grapevine transplants could be grown to a full crop in the year of planting. While research on such systems is still in its infancy, potential benefits could entail reduced establishment costs for growers, greater flexibility in site-specific cultivar selection, and reduced risk of long-term systemic grapevine diseases. Here we investigated the impact of supplemental light intensities on plant growth and dormant bud inflorescence primordia development of the grapevine cultivars Concord and Traminette. Vines were grown in a controlled environment greenhouse under three daily light integral (DLI) treatments. Our results showed that growth parameters such as stem diameter (mm), vegetative dry mass (g), root dry mass (g) were greater at high light intensity across both cultivars. Moreover, increased light intensity showed a significant effect on net photosynthetic rate. In addition, average inflorescence primordia per dormant bud for Traminette were 3.1 Our results indicate that grapevines respond to high supplemental light intensity with increased growth, potentially leading to higher yields. Therefore, our current research focuses on the evaluation of fruiting capacity of light-conditioned grapevines.

Improving Frost Mitigation with Abscisic Acid Analogs – Influence on Grapevine Bud Cold Tolerance and Dormancy Status

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Abscisic acid (ABA) is a central mediator of dormancy status and cold tolerance of grapevine buds. This phytohormone is turned over to inactive metabolites following the release of endogenous growth inhibition. Unseasonably warm temperatures in ecodormancy favor the premature loss of bud cold tolerance and increase the vulnerability of newly emergent tissue to frost damage. We have previously demonstrated that ABA analogs delay in-field bud break by improving the phenotype of cold tolerance at deacclimation. Our current research seeks to characterize the effect of ABA form (analog versus natural) and concentration on bud cold tolerance and endo-ecodormancy transition boundary. Whole canopies of *V. vinifera* Merlot and interspecific *Vitis* hybrid Marquette were treated after harvest with 8'-acetylene ABA, tetralone ABA, S-(+)-ABA (ProTone®, Valent BioSciences), and a control. Cane material was collected every three weeks following spray application in the 2021-2022 dormant season. Cold tolerance was evaluated by differential thermal analysis and reported as LT50. Single-node cuttings were maintained in a controlled environment to monitor the progression of bud break against a fixed time-to-event threshold of 60 days. Results to-date indicate a negligible impact of 8'-acetylene ABA and tetralone ABA on Merlot and Marquette bud cold tolerance relative to exogenously-supplied ABA and untreated grapevines. Rather, bud forcing assay data suggests the timing of dormant state transition may be delayed with ABA analog application in a rate-dependent manner. Observations will be correlated to date of in-field bud break. Our work lays the foundation to develop a novel frost mitigation strategy for use by growers.



Student Presentation Competition Abstracts

Sensory Impact of New York Hardwoods on Aged New York Wines

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Oak barrels, traditionally constructed from *Quercus* species, modify wine's sensorial properties during aging via extraction and oxidation. New York State has a burgeoning wine industry and valuable forestry resources, but there are few regional cooperages or wood available for local barrel production. Local white oak was evaluated for suitability in wine aging along with other regional hardwoods. Multiple samples of New York air dried white oak, white ash, sugar maple, black locust, and black cherry were sourced, and a sample of Missouri white oak used as a control. Samples were split into six toasting treatments conducted in an electric convection oven to simulate barrel toasting. Following toasting, wood samples were shaved, and 3g/L combined white wine and stored for 21 days without light at 16C. Wines were then filtered and presented for sensory evaluation using the Rate All That Apply K Attributes method. Fourteen wine industry professionals evaluated the 36 treatments over four sensory sessions, selecting and ranking the intensity of up to five attributes from mouthfeel and aroma categories compiled from literature. Sensorial differences in aroma, mouthfeel and taste were correlated to combined effects of species and toasting in statistical analysis.

Reductive Off-Aroma in Canned Wines – Compositional Factors Related to H₂S Formation

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Annual sales of canned wines have grown from about \$5 million in 2016 to roughly \$250 million in 2020. However, canned wines also demonstrate a greater incidence of reductive off-aromas due to the presence of hydrogen sulfide (H₂S), which has the aroma of rotten eggs. To determine the factors responsible for H₂S formation in canned wines, we used a validated accelerated aging protocol in which lined aluminum coupons were incubated in 25 mL of wine and stored at 50 °C for up to 14 days. Ten different wines (white, red, and rosé) and aluminum coupons lined with acrylic, BPA epoxy, and Gen II BPA – non-intent (BPA-NI) liners were used. Molecular sulfur dioxide (SO₂), pH, and free SO₂ were most strongly correlated with H₂S formation in the presence of epoxy and Gen II BPA-NI liners. By identifying these key contributors, we have increased the predictability of H₂S formation in canned wines, making canned wine a more viable option for producers.

Optimizing Microvinification for Determining Aroma, Smoke Taint and Phenolic Extraction in Wine

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It has become standard practice to conduct research winemaking at volumes of 20 liters or greater, in part because it is unknown how representative smaller volumes are to commercial or pilot scale production. To approximate winemaking when using small volumes, labs currently use acid hydrolysis or enzymatic digestion. We investigated the value of using microvinification (fermenting grapes using 50 ml tubes) to determine if this method can represent larger scale wine production. Cultivars Chambourcin and Noiret were used in optimizing microvinification parameters of temperature, time and punch down method. All varieties were analyzed by the Adams- Harbertson Assay and by GC-MS. In the microvinification trial, optimum conditions varied depending on compound of interest. In 2018 Chambourcin, the concentration of iron reactive tannin increased with length of fermentation 46.31 to 111.28 mg/l at 5 and 9 days respectively. Anthocyanins decreased with increasing temperature from 432.25 at room temperature to 298.12 M3G equivalents at 35Å°C. Smoke taint glycosides were measured in grapes exposed to smoke with GC-MS and microvinification was compared to results by acid and enzymatic hydrolysis. Acid hydrolysis was found to overpredict the concentration of some glycosides as compared to fermentation. It was found that microvinification releases smoke taint compounds similar to enzymatic hydrolysis for most compounds. For example, in Cabernet Sauvignon, the concentration of 4-ethylguaiaicol was 126.27, 2.63, and 1.30 ng/ml for acid hydrolysis, enzyme hydrolysis and microvinification respectively. Acid hydrolysis also suffered from being highly variable with a coefficient of variance 10-fold greater than other treatments.



Technical Session Abstracts

Focus on Texas Wine - A Consumer Perspective

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Texas has an expanding grape and wine industry that has doubled over the last decade to over 700 wineries. An online consumer survey (n > 600) was implemented via Qualtrics to understand attitudes towards wine purchasing and consumption with an emphasis on Texas-made wines. The survey opened in July 2021 and closed in August 2021, after the desired number of valid responses had been reached. After the survey, the consumers were categorized as either "Texas wine drinkers" (TD) or "Texas wine rejecters" (TR) to identify reasons for rejecting Texas wines as well as factors that might persuade rejecters to become Texas wine drinkers. General preferences pertaining to wine styles, consumer wine behavior, and general attitudes towards new and unknown wines were evaluated, regardless of Texas consumer status. Of the 613 valid responders, 63 (11%) were categorized as Texas wine rejecters (never drink Texas wines). TRs were 56% male, 59% live in a city, and 67% were white. They preferred sweet wines (23%) to dry wines (10%) while 44% indicated that they chose their style of wine based on the occasion. The main reason indicated for not drinking Texas wines was a lack of information and education. TDs indicated price as the most important decision factor when purchasing a Texas wine (44%) followed by sweetness level and quality. When choosing a Texas wine, it was because they perceived it to be good quality (78%) and because it offered good value for money (56%). Finally, 55% of TDs said they would be willing to pay more for higher quality Texas wines.

Consumer Liking, Interest and Willingness to Pay for Vidal and Marquette Table Wines

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Producers and consumers in Ontario, Canada want quality, locally produced table wines for \$10-12 (CAD). This study investigated a white (Vidal Blanc) and red (Marquette) grape cultivar for increased table wine production based on consumer liking, interest and willingness to pay. Consumer tastings were conducted in fall 2021, with separate sessions for white (102pp) and red (113pp) wines. Pre-qualified consumers evaluated 9 wines and rated their overall liking on a line-scale anchored from 'dislike extremely' to 'like extremely', describe the wines most defining characteristics using the check-all-that-apply (CATA) and completed an end questionnaire. For Vidal, there were not large differences in overall liking scores. Cluster analysis (AHC) was used to segment consumers by liking and found 17% liked fruity wines, 36% liked dry and complex wines and 47% like sweet and complex wines. Consumer interest was high for Vidal, 78% of consumers would be willing to try this table wine and would expect to pay \$13-16 (CAD) per bottle. For Marquette, overall liking was defined by wine styles and not wine cultivars. The least liked wines described by off-flavors. AHC segmented consumers by liking and found 20% like fruity wines, 27% liked full body with black fruit, 34% liked full body with spice and 19% liked complex, full body wines. Marquette wines had low consumer familiarity and recognition but high consumer interest with 90% of consumers interested and willing to pay \$15-21 (CAD) per bottle. Overall, both Vidal and Marquette wines show potential for high quality, entry level table wines.

Resources in USDA Cold-Hardy Germplasm: What We Have and What We're Working On

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The USDA-ARS Cold-Hardy grapevine germplasm collection is in Geneva, NY, and a part of the National Plant Germplasm System. The collection contains 1200 unique accessions, spanning 21 *Vitis* species and has over 700 interspecific hybrids. The collection is a conservation library of genetic diversity in grapevine and is a resource of genetic material for breeders, pathologists, taxonomists, other scientists, and growers. We freely distribute materials to researchers every year, which consists of not only dormant canes for growing their own vines but leaves, berries, and pollen. We also share data developed by stakeholders and our own lab. Multiple descriptors are already published and publicly available through our national database, GRIN-Global, including phenology data, morphological descriptors, and basic chemical descriptors (e.g., BRIX) to help researchers find traits they are searching for. We have begun research projects to update the database with additional descriptors which include bud cold hardiness, juice chemical composition (e.g., phenolics, terpenoids), hybrid parentage, and high-throughput phenotyping of powdery mildew and downy mildew resistance in the collection.

The Climate, Soils and Phenology of New Mexico Vineyards

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Grapes (*Vitis vinifera* L.) have been cultivated in New Mexico since 1629. However, actionable climatic and edaphic information is needed for successful vineyard site and cultivar and rootstock selection. New Mexico's arid to semi-arid, continental macroclimate contains highly variable meso-climates due to the state's wide latitudinal range and elevation variation. Phenology of selected cultivars and weather records at Las Cruces, NM were collected to quantify and compare temperature effects on budburst, flowering, fruit set, veraison and harvest from 1950 to 2020. The ten-year averages (2011-2020) calculated for seasonal growing degree days (GDD, based on 50 °F) at 13 vineyard sites throughout the state ranged from 1800 to 5100. Other ten-year average weather components impacting wine grape production are presented and compared e.g., daily high temperatures (< 70 °F, > 72 °F, > 90 °F, > 95 °F, > 100 °F), daily low temperatures (< 32 °F, < 50 °F), number of frost-free days, average daily minimum temperatures during harvest, and precipitation (amount and timing). Additionally, soil analyses from ~100 sites within New Mexico's three American Viticultural Areas (AVAs) are described and statistically modeled, with selected comparisons to more established wine growing regions, to aid effective, long-term viticultural decision making in New Mexico.

Conference Grant

North Central Sustainable Agriculture and Research Education

Technical Session Abstracts

The North Dakota State University Grapevine Variety Trial: A Stable of Cold-Hardy Grapevines, but Are Any Grapevines Stable?

Andrej Svyantek, John Stenger, Bülent Köse, Collin Auwarter, and **Harlene Hatterman-Valenti***

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Grapevine production is relatively new to North Dakota, a state with less than twenty-years of legal commercial wine production. In response to the needs of grapevine growers and winemakers, the first grapevine variety trial in the state was established in eastern North Dakota in 2004. Varieties were assessed for performance consistency via multiple stability metrics for the 15 different grapevines which persisted across 13 years of yield evaluation (2007-2019). Two of the top yielding vines, 'King of the North' (6.81 ton/ha) and 'Valiant' (6.77 ton/ha), were also the most stable according to coefficient of variance (CV) and superiority measure (Pi), respectively. The stability metrics most closely associated with top yielding lines included CV, regression coefficient (bi), Pi, and non-parametric statistical methods (Si1, and Si2). 'King of the North' and 'Valiant' were followed by 'Frontenac' (4.75

ton/ha) and 'Bluebell' (4.10 ton/ha). Most other grapevines yielded medium-to-low, averaging between 3.32 and 2.71 ton/ha. In this period, two substantial crop failures occurred in 2010 and 2019 following freeze events that left most cultivars with little-to-no crop. The consistent inconsistency of grapevine performance as measured by yield, as well as fruit composition, are indicative of the multilayered Genotype × Environment interactions that are an on-going challenge to perennial fruit production in North Dakota's season limited environment bookended by sustained freezing conditions. However, implementing techniques for variety differentiation, such as stability analysis, may aid in identification of specific grapevines with potential adaptation for the challenging and changing climatic conditions facing hybrid grapevine growers.

Establishment of a Bud Hardiness Monitoring Program in Québec, Canada

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Quebec is the host to 158 wineries with a total of 975 hectares under vine.

Temperatures can drop below -30°C in the winter which significantly limit the cultivars that can be grown without protection. A bud hardiness monitoring program was established during the 2019-2020 winter with the goals of better understanding cold hardiness of hybrid cultivars in Quebec's cold climate. Bud samples from Frontenac, Frontenac blanc, Frontenac gris, Marquette, Petite pearl and St-Pépin were collected regularly during the last three dormant seasons from 12 vineyards to determine cold hardiness (differential thermal analysis) and bud survival (dissection).

Daily temperatures were recorded on each site using data loggers. The first winter, 2019-2020, was characterized by late acclimation and the largest site differences of the three years studied. The 2020-2021 winter had the warmest temperatures and lead to lower hardiness and minimal bud

damage. The current winter, 2021-2022, was the coldest to date and 20% to 80% primary bud death was observed across all cultivars on all sites. The genetic diversity of the interspecific hybrid was not reflected in their cold hardiness phenotype and cultivar differences were lower than expected. Their LT50 often reached below -31°C, resulting in adequate winter survival on most sites. Predictably, hardiness was heavily dependent on temperatures, and sites with higher winter temperatures tended to have lower hardiness. Our results demonstrate the importance of regular sampling to evaluate cold damage risk. A better understanding of cold hardiness through annual data collection is also necessary to build robust prediction models.



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Technical Session Abstracts

Developing a Cold Climate Grape Extension Program in the Upper Midwest

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The upper Midwest grape industry has expanded dramatically since the mid-1990s. Prompted by the introduction of University of Minnesota premium hybrids, capable of surviving extreme winter temperatures, new wineries and vineyards developed rapidly across Minnesota, Wisconsin, Iowa, and the Dakotas. One implication of this rapid expansion is that most vineyards are less than twenty years old. Furthermore, a significant portion of grape growers are considered beginning farmers with less than ten years of farming experience. Likewise, viticulture education is also a relatively new area of university Extension programs in the region. Cross-state Extension collaborations have developed over the last several years to support the unique needs of grape growers farming hybrid cultivars in our extreme climate. In 2020, University of Minnesota Extension and University of Wisconsin-Madison Extension formed the Cold Climate Grape Webinar Series. From 2020-2022, the webinars attracted approximately 3,000 participants between live participation and video views. The majority of participants watched the recordings, which underscores the importance of posting recordings online. The timing and topics of webinars in 2021 and 2022 were designed based on end-of-year evaluations from webinar participants the previous year. A 2021 needs assessment with 128 respondents revealed important industry demographics, priority issues, pest management knowledge, and preferred education delivery methods. Pest and canopy management topics were ranked most important. Growers listed webinars, association listservs, and Extension webpages as the most popular delivery methods. Results from the webinar evaluations and needs assessment will be used to guide future cross-state research and Extension projects.

What's "Vinifera-like"? Consumer Perception of Hybrid Red Wine Color

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The color of red wines produced from interspecific hybrid grapes may differ from *Vitis vinifera* due to variance in anthocyanin species, interactions, and concentration. Traditional wisdom holds that wine consumers dislike red wines with color that isn't "vinifera-like," so time and effort is often spent to modify the inherent color of interspecific hybrid wines. Consumer studies of wine color perception, however, are rare, and sensory assessment of non-vinifera wine color is rarely reported. To evaluate consumer sensory perception of interspecific hybrid wine color, eight commercial wines were sourced from US regions, including five non-vinifera monovarietal wines (Corot noir, Maréchal Foch, Marquette, Norton, and St. Croix) and three Pinot noirs from France, Oregon, and New York. Eighty-six pre-screened red wine consumers were asked to report liking for a selection of color parameters as well as 'expected liking' prior to tasting the wine and 'actual liking' following in-mouth evaluation. For all color parameters (hue, intensity, and overall appearance), the wines ranked highest for liking included Maréchal Foch, St. Croix, and the Pinot noirs from France and Oregon. Expected liking from visual examination was highest for St. Croix, though a majority of panelists expected to like all wines except Corot noir and Norton. Notably, for most wines, panelists reported that quality expectations formed from visual inspection did not match their actual liking of the wine. This work suggests that consumers only use color as a weak predictor of expected liking, freeing producers of the need to amend hybrid red wine color.

Survey of the USDA Cold-Hardy Germplasm for Grapevine Trunk Diseases

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Grapevine trunk diseases (GTDs) are a set of economically important fungal diseases that form a complex of multiple symptomologies and causal agents spanning both the Ascomycota and Basidiomycota. GTD fungal populations are well known in wine-growing regions within the US and around the world and impact profitability of vineyards after 10 years. This has led to many regions establishing routine management practices to prevent GTDs. However, GTDs are not as well understood in the Northeastern US and are a concern to growers as their vineyards expand. The last in-depth survey effort in the Northeastern United States (2008-2009) identified many known GTD fungal species and led to the description of five new species. The aim of this survey was to determine to what extent GTD fungi are present in the USDA Cold-Hardy Germplasm located in Geneva, NY which has over 1400 genetically diverse accessions originally collected from around the world over the past 40 years. Dormant woody canes and trunk sections were collected in January through March 2022, surface sterilized, and plated on to antibiotic potato dextrose agar. Fungi were isolated, morphologically categorized, and sequenced using primers ITS 1 and ITS 4 for identification. Additionally, the first GTD-focused spore trapping survey in the Northeastern US was completed at three locations around Geneva, NY to determine spore pressure April through May 2022 to determine spore spread and begin developing recommendations for management practices.

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UNIVERSITY OF MINNESOTA EXTENSION

Technical Session Abstracts

A Wine Industry Dilemma: Does Crop Size Reduction Make Better Wine?

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Midwestern grape growers have been searching for a way to improve wine quality and make their product more desirable to the consumer. Although controversial, one method that has been documented in California involves limiting the amount of fruit the grapevine is allowed to produce. Grapevines with limited crop load have shown to produce fruit with lower pH and titratable acidity, increased soluble solids (sugar content), enhanced varietal flavor and enhanced color, resulting in a higher quality wine. By increasing wine quality, wineries could be able to sell their product for a higher price. Additionally, grapevines that are not continually over-cropped have been shown to produce more consistent and higher quality fruit. However contradicting research has shown no wine quality benefit from crop reduction and little information has been documented for cold hardy hybrid cultivars. To assess if crop reduction is viable, the University of Nebraska Viticulture Program began a project in 2020 at two commercial vineyards (Miletta Vista Winery and Prairie Creek Winery) in Central Nebraska. Four cultivars (Itasca, La Crescent, Frontenac and Marquette) were chosen based upon their typical higher yields. Within these, 0% (control), 25%, 50% of the clusters were dropped at fruit set. The vines were grown and managed in a standard fashion throughout the growing season and harvested in late August. The study was repeated again in 2021, using the cultivars Itasca and Frontenac Gris. To this point, Itasca has exhibited the most potential to be positively impacted by cluster thinning where the 50% fruit drop plants produced an average of 7.7 lbs per plant while the control produced 14.5 lbs. This study is being repeated in 2022 and this third year of results will allow us to make more sound recommendations to Nebraska growers.

Evaluation of New Wine and Table Grape Cultivars in Texas

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Grape production in the eastern areas of Texas is limited by Pierce's Disease (PD) and fungal diseases. Texas A&M has evaluated many new grape cultivars and numbered selections to identify table grapes and wine grapes with commercial potential. Blanc Du Soleil is a white wine grape from Florida A&M University that has been under trial in Texas since 2011. The cultivar has shown good foliar fungal disease resistance with moderate yields of medium-sized, well-filled clusters. Wine quality has been very high with flavor characteristics compared to Pinot Gris. Camminare Noir is a new PD tolerant red wine grape released by the University of California Davis. In 2021, in the Texas Gulf Coast, fifth leaf Camminare Noir grafted on 420A and 1103P produced 10.5 and 8.6 tons/ha, respectively. Fruit composition was satisfactory (soluble solids = 22.1%, titratable acidity = 5.12 g/L, and pH = 3.71), but uneven ripening and poor color was observed. Southern Sensation Seedless is a PD tolerant seedless grape selected by the University of Arkansas in 1973 and released by the University of Arkansas and Texas A&M University in 2021. Southern Sensation Seedless has large cluster ranging in size from 116 to 575 g in Arkansas and Texas, with berries ranging from 1.97 to 2.3 g. Skin is thin with good resistance to cracking and berries have a crunchy texture and mild, fruity flavor. This cultivar is recommended for vineyards in USDA cold hardiness zone 7b and warmer.

Indulgence and Dazzle Wine Grapes for the Mid-South

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Indulgence and Dazzle white wine grapes are new cultivars (*Vitis* hybrid) developed by the University of Arkansas System Division of Agriculture. These grapes are the third and fourth wine grape cultivars from the program and have shown good adaptation and consistent productivity in Arkansas. Indulgence is a cross of Seyval × Muscat Ottonel selected in 1992 and 'Dazzle' is a cross of Gewürztraminer × Melody selected in 1995. The average harvest date for these cultivars is mid-August. The composition attributes at harvest of 'Indulgence' were soluble solids of 16.9%, pH 3.3, and titratable acidity of 0.64 mg/100 ml (as tartaric acid). 'Dazzle' had soluble solids of 19.9%, pH 3.3, and titratable acidity of 0.70 g/100 ml. Yield of Indulgence averaged 17 kg/vine with 153 g clusters and 2.5 g berries. Yield of Dazzle averaged 10 kg/vine with 162 g clusters and 1.9 g berries. Both cultivars showed good winter hardiness down to -9°C. The grape, juice, and wine of Indulgence had citrus, grapefruit, and muscat-like attributes, whereas 'Dazzle' had floral and stone fruit attributes. Indulgence wine had a pH of 3.29 and titratable acidity of 0.60 g/100 mL, and Dazzle wine had a pH of 3.27 and titratable acidity of 0.69 g/100 mL. The ethanol levels of the wines were 10-12%. Indulgence and Dazzle grapes produced wines with unique and pleasant aroma and flavor characteristics that could provide new opportunities for grape growers and wine makers and can expand wine options for Arkansas and other regions with similar growing conditions.

How Does the Quality of Cold-Hardy Hybrid Red Wines Change Over Time?

Carmen Vavra, Yiliang Cheng, Alexander Gapinski, and **Aude A. Watrelot***

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Cold-hardy red wines tend to have much lower concentrations of tannins than *Vitis vinifera* wines. This impacts quality over time, including increased risk of oxidation and reduced astringency which leads to unbalanced wines. Because the chemistry of red wines produced from interspecific cold-hardy grape cultivars compared to *Vitis vinifera* is not well known, it is a challenge to determine the best winemaking practices to produce a high quality wine that remains stable during aging. In current studies, the quality of cold hardy 'Marquette' and 'Frontenac' red wines was evaluated by quantifying pH, titratable acidity, alcohols, organic acids, total phenolics, tannin content, and color characteristics throughout winemaking from crushing to 9 years of aging. In addition, the amounts of free and total sulfur dioxide have been evaluated in wines at bottling and after aging to investigate the change in sulfur dioxide level over time. This study provides an overview of various winemaking practices applied to those interspecific cold-hardy grape cultivars such as whole clusters, enzyme addition, and high-power sonication and their impact on red wine quality over time. The evolution of both chemical properties and aroma compounds of those cold-hardy grape cultivars in red wines aged from 2013 to 2020 have also been investigated. The goal being to help improve quality of red wines made from cold-hardy grapes to increase consumer acceptance for consumers and to develop optimal winemaking practices for non-*Vitis vinifera* grapes.

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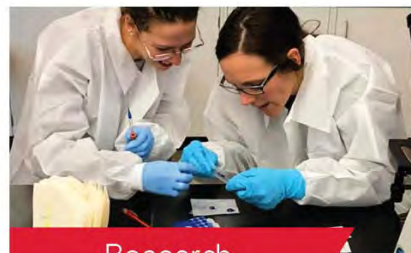
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Student Poster Competition Abstracts

Impact of Post-Fruit Set Leaf Removal on Marquette Grape Chemistry During Development and Ripening

Yiliang Cheng, Lucas Buren, Gail Nonnecke, and Aude A. Watrelot*

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Red wines from cold-hardy grape cultivars tend to be low in tannin, which might be due to a low initial content in grapes at harvest. This work focused on the evolution of berry composition and phenolics content, especially tannins, during development and ripening with or without leaf removal. 'Marquette' grapevine leaves (6 to 8) were removed or not (control) from the shoot base, at post fruit-set in 2020 and 2021. Rain precipitation and temperature were recorded and growing degree days calculated. Basic chemical analyses (pH, titratable acidity, °Brix) were conducted and total iron-reactive phenolics (IRP), tannins, and anthocyanins content and color intensity in juices determined. In both years, the °Brix was significantly higher at véraison in grape juice from vines with leaves removed (ELR), but did not differ at harvest. The content of IRP was significantly higher after leaf removal from post fruit-set to véraison, but no impact on tannin content was observed. IRP and tannin content dramatically decreased until being close to null from véraison to harvest. Higher levels of anthocyanins and color intensity were observed at harvest in grapes of ELR, which could be associated with increased sunlight exposure. The differences in phenolics content between two growing seasons may be due to higher rainfall and temperatures in 2020. The reduction of phenolic compounds content in the 'Marquette' juice during ripening regardless of leaf removal treatment suggested that either the biosynthesis or the extractability of phenolic compounds in grapes is strongly associated with maturity stages rather than leaf removal.

Effect of Whole Cluster Fermentation on Phenolics and Sensory Perception of Marquette Wines

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Red wines made from cold-hardy interspecific hybrid grapes result in wines with much lower tannin content than *Vitis vinifera* wines and are often perceived as lower quality. This study evaluated the chemistry and sensory perception of whole-cluster (WC) fermented 'Marquette' red wines from Iowa (M-ISU) and Minnesota (M-UMN). Three conditions were compared: Control 0% WC (w/w), 25% WC (w/w), and 50% WC (w/w). Basic chemistry of all wines, including pH and titratable acidity, was determined throughout the winemaking process up to 4-months of aging. Organic acids, alcohol content, and tannin content were quantified by reversed-phase HPLC-DAD/RID; iron-reactive phenolics, color intensity, and hue were measured using a UV-Vis spectrophotometer. A sensory evaluation was carried out with winemakers to describe the wines and identify preferences. The pH of the M-ISU wines was higher than the M-UMN wines, while color intensity and alcohol content were higher in M-UMN wines. From crushing to 4-months of aging, the total iron-reactive phenolics content increased in all M-UMN wines but only increased in the M-ISU wines from crushing to bottling. After 4-months of aging, panelists preferred the M-UMN-25%WC, M-UMN-50%WC, and the M-ISU-50%WC wines over the respective controls. With ratings higher for fruit intensity and lower for vegetal aromas, panelists preferred M-UMN wines over M-ISU wines. Tannin content was higher in most whole-cluster wines than the controls, but they were not rated higher in body. Our study showed promising results on the use of 50% w/w whole clusters as a pre-fermentative technique to improve 'Marquette' red wine quality.

Survey of Wine Purchasing and Consumption Habits of Consumers of Commercial Arkansas Wines

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The grape and wine industry significantly impacts the Arkansas economy. In 2021, the University of Arkansas System Division of Agriculture conducted an online survey to better understand consumer wine purchasing and consumption habits and perceptions of the quality of Arkansas-made commercial wines. A drawing for gift cards was used as an incentive for survey completion with 183-273 consumers responding to the survey. Participants were 65% female, 70% married, most 21-70 years old, and 88% resided in Arkansas. Over 90% of respondents were wine consumers, while the remaining were wine consumers as well as grape growers and/or wine producers. Thirty-one percent of the consumers drink red and white wine 2-4 times/month, while 38% drink rosé/blush less than once per month. Over 89% purchased wine for personal consumption, consumption with family and friends, and special occasions. Cost, varietal, and origin were consumers' top three most important factors when purchasing wine. While only 43% of respondents were somewhat aware of commercial wineries in Arkansas, 80% have visited Arkansas wineries 1-10 times, and 53% thought it important to purchase locally-made wines. Nearly half of respondents (49%) thought Arkansas wineries produce quality wines, 91% preferred to purchase wines made with Arkansas-grown grapes, and 81% had purchased Arkansas wines. Arkansas wine consumers want to purchase wines made in Arkansas but are inhibited by a perceived lack of quality. Arkansas grape growers and wine producers can use survey results to improve grape and wine quality perception using targeted marketing strategies.

Sampling Missouri Vineyards- A Weed Survey

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Weed surveys in vineyards are an important tool to periodically identify the diversity of current weed species and low populations of new and potentially troublesome species. Surveys can then serve as a guideline for adjusting current or developing new weed management strategies. A weed survey was conducted in ten Missouri vineyards across the state in fall 2021. Prior to surveying, the number of sample points was established based upon the total acreage of each block (an area of the same hybrid with similar management practices). Each sample point, consisted of 3, 0.25 m² areas selected at random throughout a vineyard. Each species and the number of individual plants was tallied. Across all vineyards, the two most abundant (based on percentage of sample points detected) perennials included white clover (*Trifolium repens*) (22.1%) and horsenettle (*Solanum carolinense*) (2.42%). Annual broadleaves included common purslane (*Portulaca oleracea*) (13.1%) prickly sida (*Sida spinosa*) (3.89%) and prostrate knotweed (*Polygonum aviculare*) (3.53%). Annual grasses included large crabgrass (*Digitaria sanguinalis*) (36.4%) and tall fescue (*Festuca arundinacea*) (12.3%). A total of 34 species were detected in the 10 vineyards (447 sample points), with 3.4 being the mean number of species found at each vineyard. It is likely that the species composition and density is a reflection of weed management practices. Each vineyard will be sampled again in spring 2022 to estimate winter annual weed populations.

Student Poster Competition Abstracts

The Efficacy of Mushroom-Derived Chitosan as a Fining Agent for Sparkling Wine Juice

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Chitosan is a naturally synthesized biopolymer derived from crustacean exoskeletons and the cell walls of fungi. In the field of winemaking, chitosan (produced from *Aspergillus niger*) is now available commercially for use as an antimicrobial agent, though it also possesses absorbent and antioxidant properties. The aim of this study was to determine the ability of chitosan, produced from *Agaricus bisporus* (button mushrooms), to reduce specific phenolic (bittering) compound concentration (caffeic/caftaric acid) from sparkling base wine juice, as well as its influence on total hydroxycinnamic acids (HCAs), browning pigmentation, and turbidity. Pinot noir (clone 667, 3.5t/ac) grapes were harvested on August 30th, 2021 from a vineyard located in Niagara-on-the-Lake, Ontario. Grapes were hand harvested, stored at 10Å°C overnight, and whole-bunch pressed the following morning. The pressed juice was separated into 15 separate 11L carboys and stored for 18 hours with the following treatments: No addition control, Bentonite/activated charcoal positive control, <3kDa (Low MW) chitosan, 250kDa (Medium MW) chitosan, and 422kDa (High MW) chitosan. Juice was racked, settled, inoculated with IOC-2007 yeast, and fermented to dryness in eight days. The Low MW chitosan treatment decreased caftaric acid ($p < 0.001$), but increased amino acids ($p < 0.001$). Medium MW chitosan decreased total HCA estimation ($p < 0.001$), turbidity ($p < 0.001$), and degree of browning ($p < 0.003$). Additionally, lower residual sugar levels were observed in all treatments relative to the control ($p < 0.05$). Results suggest that mushroom-derived chitosan has potential as a novel and sustainable winemaking tool.

Association Study of Cold Hardiness in Interspecific Wine Grapes (*Vitis* spp.)

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Cold tolerance of grapevines (*Vitis* spp.) varies significantly throughout the dormant season, especially in response to fluctuations in temperature. Extreme temperature fluctuations are ubiquitous in the North Dakota climate, negatively affecting grapevine cold hardiness. Therefore, identifying genes involved in cold hardiness is needed to aid in grapevine cultivar development. An incomplete diallel population of 1064 F1 individuals was used to estimate cold tolerance through differential thermal analysis (DTA). In December and February of 2020-2021, dormant canes were collected from the field on consecutive days until all individuals were sampled. Buds were removed from the canes, placed in thermoelectric modules with sensors, and placed in a programmed freezer. When the bud of the grapevine freezes quickly under freezing conditions, we're able to observe the freezing point, also known as the Low-temperature exotherm (LTE) recorded in the system. LTE obtained from DTA was used as phenotypic data. In addition, we used genotyping by sequence (GBS) to generate genotypic data for the population containing ~25900 single nucleotide polymorphisms (SNPs). This study aims to identify the genomic regions associated with complex traits such as acclimation and cold hardiness through a genome-wide association study using phenotypic and genotypic data. The results have shown no significant SNPs that could be linked to cold hardiness in our population.

Effect of Maceration and Post-Maceration Enzyme Additions on Tannin Concentration in Hybrid Wines

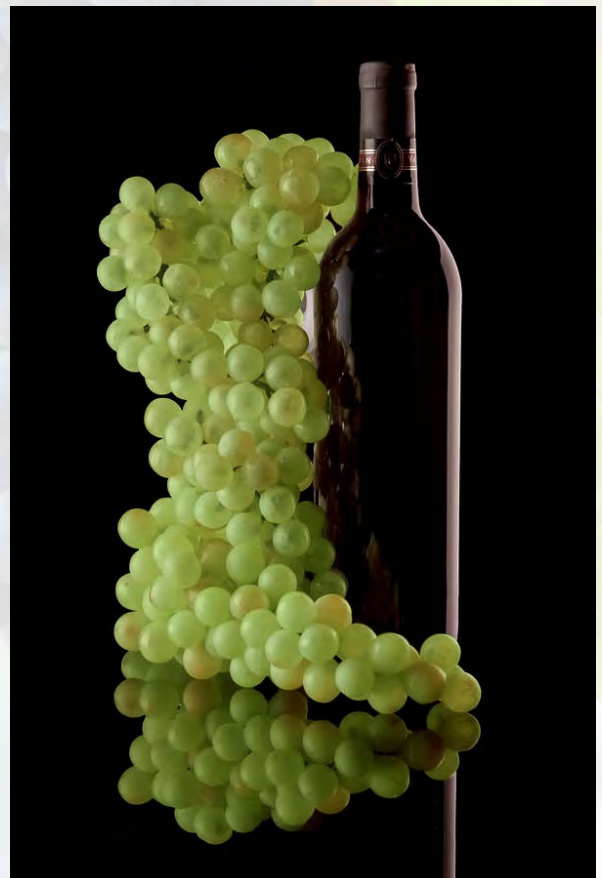
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Despite their significant viticultural advantages, wines made from interspecific hybrid grape varieties (*Vitis* spp.) are often considered of inferior quality in part due to their lower tannin concentrations compared to wines from traditional European grape varieties (*Vitis vinifera*). This study examines the effect of three hydrolytic enzymes (pectinase, cellulase, and protease) on the extraction and retention of tannins in wines produced from two hybrid grape varieties (Noiret and Chambourcin).

Benchtop trials were performed using 50 mL micro-vinifications in biological quadruplicate. Enzymes were added in a partial combinatorial design either at crush or post-pressing at two enzyme addition rates for a total of 18 treatments. Pilot scale fermentations and sensory evaluation were performed using the 3 most promising treatments. Tannins were characterized by measuring total phenolic content (TPC) with the Folin-Ciocalteu method, tannin concentration using both protein precipitation (Adams-Harbertson) and methylcellulose precipitation, and anthocyanins and polymeric pigments using the Adam-Harbertson method. Added separately, pectinase, cellulase, and protease had no significant effect on the tannin concentration or TPC in resulting wines. However, post-maceration addition of a combination of pectinase, cellulase, and protease significantly increased ($p < 0.001$) tannin concentration (41.2 mg/L CE tannins) compared to the control (28.6 mg/L CE tannins). Post-maceration addition of pectinase, cellulase, and protease in combination and maceration addition of cellulase and papain in combination significantly ($p < 0.05$) increased TPC in the wines compared to the control (129, 124, vs. 99 mg/L GAE, respectively). Pilot scale fermentations followed similar trends to earlier micro-vinifications.



Poster Session Abstracts

Acidity Modification in Wine Fermentations from Arkansas-grown Chambourcin Grapes Using Non-Saccharomyces Yeast Amanda J. Fleming and Renee T. Threlfall*

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The commercial use of non-Saccharomyces yeast to modify acidity and other wine attributes during fermentation has increased. In 2020, Chambourcin (*Vitis hybrid*) red wine grapes were harvested from a commercial vineyard in Arkansas, randomized into four fermentation treatments in duplicate, crushed, and destemmed. Treatments included two fermentations with *S. cerevisiae* (SC) with and without malolactic fermentation (MLF) and two fermentations with *Lachancea thermotolerans* (LT) followed by a sequential inoculation of *S. cerevisiae* (LT-SC) with and without MLF. Basic composition, sugars, and organic acids of must/wine were evaluated daily during fermentation for 7 days at 21°C. Prior to inoculation, the must had 21.34% soluble solids, 3.43 pH, 0.78% titratable acidity, 19.51% total sugars, and 0.90% total organic acids (primarily 0.35% tartaric, 0.33% malic, and 0.18% lactic). Regardless of MLF, SC treatments completed fermentation (<0.3% sugar and 10% ethanol) at 5 days, whereas LT-SC treatments completed at 7 days. At 5 days, there was not a difference in tartaric acid, and regardless of MLF, lactic (0.65-0.66%) and total organic acids (1.25-1.27%) of LT-SC treatments were higher compared to SC treatments, while pH was lower (3.26-3.33) than SC wines. From day 0 to 5, LT-SC-MLF had the greatest reduction (12%) in malic acid compared to SC-MLF (9%) while LT-SC and LT-SC-MLF had a 3.5-4.0% reduction in pH. At day 5, lactic acid production for SC-MLF was 12%, but tripled in LT-SC (46%) and LT-SC-MLF (47%). Increases in lactic acid using *L. thermotolerans* broadens options for smoother, more complex wines with improved stability.

Entomopathogenic Nematodes as an Alternative Management Strategy for Grape Root Borer

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Grape root borer (GRB) is a native pest that attacks both cultivated and wild grape vines. GRB larvae spend nearly two years underground feeding, subsequently damaging vines by girdling the roots. Injury due to GRB larvae often goes unnoticed until it is too late, leading to a reduction in winter survival and fruit quality, and even vine death. Chlorpyrifos, the main insecticide labeled for use against GRB, was banned in 2022, and as such effective curative treatments for GRB control are limited. Previous research has shown that entomopathogenic nematodes (EPN) can effectively reduce GRB in grape production. During the 2020 and 2021 growing seasons, two EPN strains, *Steinernema feltiae* (Sf) and *Heterorhabditis bacteriophora* (Hb), were evaluated at commercial wine grape vineyards in north Georgia (two sites in 2020, and four sites in 2021). Pheromone-baited bucket traps were used to monitor adult GRB flight, and soil beneath the vines was examined for presence of exuviae (pupal casings). During both years, adult GRB moths were active from mid-July to early September, but substantially more moths were collected in 2020 than 2021. In terms of GRB emergence, both the Hb and Sf treatments had fewer exuviae than control vines, with Hb treatments performing the best. Similarly, when evaluating GRB management at all four vineyard sites, Hb treated vines had significantly fewer exuviae than control vines, whereas Sf had only marginally fewer exuviae than control vines. Evidence that the EPNs, particularly Hb, may reduce GRB infestation is encouraging and warrants further research.

Evaluating Foliar Fertilization for Enhanced Cold Hardiness and Fruit Quality

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Cold injury, especially from extreme temperature fluctuations, is a major limitation for grape growers in the upper Midwest. Cold onset in the autumn can be rapid, and mid-winter temperatures can reach -35°C in many years. These conditions may injure even the hardiest grapevine varieties. Freezing tolerance depends on successful acclimation, which can be influenced by factors during the growing season. Therefore, developing in-season management techniques that enhance freezing-tolerance is a priority. Due to the importance of nutrition in grapevine growth and development, calcium (Ca) and potassium (K) additions were investigated in three locally important grapevines ('King of the North', 'Frontenac Gris', and 'Marquette'). Supplemental foliar fertilization treatments (untreated control, NPK, NPK + Ca, and NPK + K) were assessed for their effect on fruit quality, acclimation, and freezing tolerance. Mean survival of primary buds 3-13 varied between 60% and 100% over a winter that reached -37.5°C. Yet, there were no statistically significant differences in primary bud survival due to fertilizer treatment. Fruit yield and quality parameters were not affected by fertilizer treatment with a few exceptions: The NPK+K treatment did increase the fruit pH of 'Frontenac Gris' relative to NPK and NPK + Ca treatments. Together, these results show that foliar fertilizers may not be effective for improving survival in severe conditions. However, foliar fertilization with NPK + K may be an effective way to raise excessively low fruit pH without affecting yield.

Poster Session Abstracts

Impact of Grapevine Leafroll-associated Virus-3 and Grapevine Red Blotch Virus on Yield and Berry Juice Quality in the American Grape Norton

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Grapevine leafroll-associated virus 3 (GLRaV-3) and Grapevine red blotch virus (GRBV) are the two viruses that are considered to pose the greatest threat to grape and wine production in the United States. Both of these viruses are prevalent in Missouri vineyards, and in particular, in the variety Norton. However, most research on the impact of GRBV and GLRaV-3 has been conducted in *Vitis vinifera*, and little is known about how they might affect the grape hybrids commonly grown in Missouri. In this study, we identified 10 Norton vines infected with either GLRaV-3, GRBV, or neither virus in a Norton vineyard, and we assessed individual berry weight, Brix, titratable acids (TA) and pH at seven different timepoints. We also determined the number of grape clusters per vine and pruning weight. In measuring berry weight, Brix, TA, and pH, there were no significant differences between vines infected with GLRaV-3 and virus-free vines. Furthermore, GLRaV-3 infection had no effect on cluster numbers per vine or pruning weight. By contrast, GRBV infection had a significant effect on several parameters. Berries from vines infected with GRBV were significantly larger than berries from healthy vines and the TA of the juice was significantly higher. Furthermore, pruning weight of GRBV-infected vines was significantly lower than healthy vines. No significant impact on Brix or pH was observed between juice from GRBV-infected vines and healthy vines. These results indicate that Norton may be tolerant to GLRaV-3 infection and may be only moderately affected by GRBV infection.

Efficacy of Selected Fungicides for the Control of *Pestalotiopsis* spp. Causing Grape Berry Rot

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Pestalotiopsis spp. were recently reported to be causing damage to grape berries in Virginia and Missouri. The causal organism although ubiquitous is relatively unknown and is not included in the Compendium of Grape Diseases, Disorders, and Pests, Second Edition. This obscurity also means little is known how to manage *Pestalotiopsis* spp. The objective of this research was to develop an in-vivo grape berry assay to assess the efficacy of selected fungicides. Briefly, Norton berries with pedicel attached were surface sterilized and then rinsed with ddH₂O four times. Berries were air-dried and then five pin pricks were made to the skin of each berry. Then berries were placed in either ddH₂O or 1X10⁶ *Pestalotiopsis* spp. conidia/L and then removed and allowed to air dry. A subset of berries was then left untreated representing controls whereas other berries were treated with the field application rate of selected fungicides. The berries were then placed on ddH₂O moistened filter paper contained within a petri plate. Each petri plate was enclosed within a plastic bag to maintain humidity and stored at 25 C. Berries were evaluated after 72hrs for incidence of disease. The statistical design was completely randomized and each petri plate contained five berries with three replications. The experiment was repeated two times. Captan 80WDG, Manzate Pro-Stick, and Pristine reduced the incidence of infection compared to the positive control whereas Rhyme, Topsin M, Badge X2, and Sonoma 40WSP would not be commercially acceptable in controlling *Pestalotiopsis* spp. grape berry rot.



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