



American Society for Enology and Viticulture- Eastern Section

43rd Annual Conference
July 9-11, 2018
King of Prussia, Pennsylvania

Workshop
Taming High pH in the East

Email: info@asev-es.org

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



Conference Overview

Conference Events: Crown Plaza

260 Mall Boulevard, King of Prussia, PA 19406

Monday, July 9, 2018

Conference Registration	Freedom Pre-function	7:00-7:45 am
Tour Pennsylvania Vineyards & Wineries	Meet in Lobby	7:15 am-5:30 pm
ASEV-ES Board Meeting/Dinner	Location Offsite	7:00-9:00 pm

Tuesday, July 10, 2018

Conference Registration	Freedom Pre-function	7:30 am-5:00 pm
Welcome and Overview	Freedom Ballroom IV-VI	8:00-8:30 am
Student Competition and Flash Talks	Freedom Ballroom IV-VI	8:30-11:00 am
Technical Sessions	Freedom Ballroom IV-VI	11:00 am-12:00 pm
Lunch and ASEV-ES Business Meeting	Freedom Ballroom III	12:00-1:30 pm
Technical Sessions	Freedom Ballroom IV-VI	1:30-5:00 pm
View Posters	Freedom Ballroom IV-VI	5:00-5:30 pm
Oenolympics & Reception	Freedom Ballroom III	5:30-7:00 pm

Wednesday, July 11, 2018

Conference Registration	Freedom Pre-function	7:30 am-2:00 pm
Welcome and Announcements	Freedom Ballroom IV-VI	8:00-8:15 am
Outstanding Achievement Award	Freedom Ballroom IV-VI	8:15-8:45 am
Student Competition and Flash Talks	Freedom Ballroom IV-VI	8:45-11:15 am
Distinguished Service Award	Freedom Ballroom IV-VI	11:15 am-12:00 pm
Lunch	Own Your Own	12:00-1:30 pm
Taming High pH in the East Workshop	Freedom Ballroom IV-VI	1:30-5:30 pm
View Posters	Freedom Ballroom IV-VI	5:30-6:00 pm
Sparkling Wine Reception and Banquet	Freedom Ballroom III	6:30-9:00 pm

ASEV-ES Conference Sponsors

(Sponsors are recognized throughout the program.)

Monday, July 9, 2018

Tour Pennsylvania Vineyards & Wineries

Meet in Crown Plaza Lobby	7:15 am
Depart for Galen Glen Winery	7:30 am
Vineyard Tour 9:00-10:15 am	
Wine Tasting and Purchases 10:15-11:00 am	
Depart for Setter Ridge Vineyards	11:00 am
Lunch 11:45 am-12:30 pm	
Vineyard and Winery Tour 12:30-1:45 pm	
Wine Tasting and Purchases 1:45-2:15 pm	
Depart for Pinnacle Ridge Winery	2:15 pm
Vineyard and Winery Tour 2:30-3:45 pm	
Wine Tasting and Purchases 3:45-4:30 pm	
Depart for Crown Plaza	4:30 pm
Arrive at Crown Plaza	5:30 pm



Tuesday, July 10, 2018

Welcome

8:00-8:15 am

Denise Gardner, Denise Gardner Wine Consulting and ASEV-ES Chair
Chris Gerling, Cornell University and ASEV-ES Chair Elect

Overview of Enology and Viticulture in Pennsylvania

8:15-8:30 am

Denise Gardner, Denise Gardner Wine Consulting and ASEV-ES Chair

Student Oral Presentation Competition (15 minutes each)

8:30-9:30 am

The Effect of Grapevine Clone on Vine Performance, Fruit Composition and Oenological Potential for Core-Ontario Varieties

Andrea Barker*, James Willwerth, Belinda Kemp, and Debra Inglis

Utilization of Remote Sensing Technology to Detect Riesling Vineyard Variability

Briann Dorin*, Andrew Reynolds, Hyun-Suk Lee, Adam Shemrock, Ralph Brown, and Marilyne Jollineau

Controls on Grapevine Vigor: Decoupling Cover Crop Competition and Rootstock

Suzanne Fleishman*, Michela Centinari, and David Eissenstat

Isolation of Dehydrin Proteins in Dormant Buds of *Vitis vinifera* cv. Riesling and Sauvignon Blanc

Andréanne Hébert-Haché*, James J. Willwerth, Belinda Kemp, and Debra Inglis

Flash Talks-Poster Summaries (3 minutes each)

9:30-10:00 am

Detecting Regionality of Pennsylvania White Wines with Consumers and Wine Professionals

Marielle Donohue, Gloria Wang, and Helene Hopfer*

Quantitative Method Validation for Dietary Flavanols with Different Degrees of Polymerization at Different Concentrations

Laura E. Griffin, Amanda C. Stewart, Andrew P. Neilson*

Evaluating Salt Exclusion and Alkaline Soil Tolerance of Muscadines and Bunch Grape Rootstocks

Daniel Hillin, George R. McEachern, Sam Feagley, Andrew King, and Justin Scheiner*

Investigations into the Effect on Wine Tannin Following a Co-fermentation vs. Post-fermentation Blending of an Interspecific Hybrid and a *Vitis vinifera* Variety

Erin L. Norton*, Sangita Singh, Joey N. Talbert, and Gavin L. Sacks

Impact of Two Frost Avoidance Strategies on Chemical and Sensory Wine Quality - First Year Results

Andrew Poveromo, Marielle Donohue, Michela Centinari and Helene Hopfer*

Early Season Leaf Removal Reduces Cluster Compactness and Yield in North Dakota 'Marquette'

Andrej W. Svyantek*, John Stenger, Collin Auwarter, Nickolas Theisen, Razi Ibrahim, and Harlene Hatterman-Valenti

Leaf Removal Timing and Extent Differentially Effect Crop Yield, Rot, and Fruit Composition in Georgia-Grown Chardonnay

Annie R. Vogel, Clark MacAllister, Nathan Eason, Rachael S. White, and Cain C. Hickey*

Break/View Posters

10:00-10:30 am

Student Oral Presentation Competition (15 minutes each)

10:30-11:00 am

Do Climatic and Viticultural Factors Influence Rotundone Accumulation in Noiret Wine Grapes?

Andrew Harner, Michela Centinari*, Ryan Elias, Bryan Hed, and Justine Vanden Heuvel

Modifying Shoot Tip Management to Reduce Lateral Emergence and Cluster Compaction in Cabernet Franc

Anne Kearney, Justin France, and Justine Vanden Heuvel*

Technical Sessions (20 minutes each)

11:00 am-12:00 pm

Influence of Flash Détente Technology on the Quality of Black Spanish Wines in Texas
Carlos Elizondo and **Andreea Botezatu***

Pruning Approaches to Revive Cold Injured Merlot Grapevines
Hemant L. Gohil*, Lynn Mills, and Markus Keller

Crop 'til You Drop? Acidity not Linearly Correlated with Yield for 'Frontenac' Grapevines
Andrej W. Svyantek, John Stenger, Collin Auwater, Nickolas Theisen, Razi Ibrahim, and **Harlene Hatterman-Valenti***

Lunch and ASEV-ES Annual Business Meeting

12:00-1:30 pm

Technical Sessions (20 minutes each)

1:30-3:30 pm

Survey for Grapevine Leafroll Associated Viruses in Pennsylvania
Bryan Hed*, Michela Centinari, and Cristina Rosa

Fruit-Zone Leaf Removal Effects on Cabernet Franc Grown in North Carolina and Georgia.
Cain C. Hickey*, Rachael White, and Mark Hoffmann

Evaluating the Effects of Under Vine Cover Crops on Noiret Vines in a Commercial Vineyard in New York State
Raquel Kallas, Justin France, Taylor Mattus, and Justine Vanden Heuvel*

Impacts of Source-Sink Manipulations on Riesling Vines in 2017-2018
Timothy Martinson*

Evaluation of the Enological, Economic and Environmental Interest of the Use of Potassium Polyaspartate
Laurent Pare and Eglantine Chauffour*

The Impacts of Frozen Material-Other-Than-Grapes (MOG) on Aroma Compounds of Red Wine Varieties
Jiaming Wang, Emily Aubie, and Andrew Reynolds*

Break/View Posters

3:30-4:00 pm

Technical Sessions (20 minutes each)

4:00-5:00 pm

Comparing Response and Recovery to Post-budburst Freeze Stress of Two *Vitis* Species
Maria Smith and Michela Centinari*

Vertical Airflow Technology for Cool Climate Appassimento Grape Drying
Darren Ward* and Dr. Amy Bowen

Evaluating Novel Hybrid Pierce's Disease Tolerant Winegrape Varieties on Three Training Systems in Georgia
Fritz A. Westover*, Paula J. Burke, Rachel A. Itle, Cain C. Hickey, Daniel L. Jackson, Jason T. Lessl, and Bruce J. Cross

View Posters

5:00-5:30 pm

Adjourn

5:30 pm

Oenolympics & Wines of the East Reception

5:30-7:00 pm

Sponsor of ASEV-ES Hospitality Suite
Lallemand, Inc.



Wednesday, July 11, 2018

Welcome and Announcements

8:00-8:15 am

Denise Gardner, Denise Gardner Wine Consulting and ASEV-ES Chair
Chris Gerling, Cornell University and ASEV-ES Chair Elect

ASEV-ES Outstanding Achievement Award

8:15-8:45 am

Terry Acree, Cornell University

Flash Talks-Poster Summaries (3 minutes each)

8:45-9:15 am

Characterization of Wine Regionality in Pennsylvanian White Wines with a Trained Sensory Panel
Gloria Wang, Marielle Donohue and Helene Hopfer*

Recombinant Identification in a Hybrid Cold-Hardy Grapevine Population for Fine Mapping: A Major Resistance QTL to Foliar Phylloxera
Lu Yin, Lance Cadle-Davidson, Qi Sun, Jason Londo, Avinash Karn, Fred Gouker, Jonathan Fresnedo, and Matthew Clark*

Effects of "Kicker" Canes on Yield and Dormant Pruning Weight in Chardonnay and Chambourcin varieties in New Jersey
Hemant L. Gohil* and Daniel Ward

New Tools for Vineyard Site Selection in the Lake Erie Region
Andrew Kirk*

Replacing Herbicides with Groundcovers to Enhance Vineyard Sustainability
Benjamin A. Loseke* and Paul E. Read

Physiochemical and Descriptive Sensory Analysis of Arkansas-Grown Muscadine Grapes for Fresh Market
Molly Felts, Renee T. Threlfall*, Margaret L. Worthington, and John R. Clark

Evaluation of Anthocyanins in Arkansas-Grown Enchantment Grapes and Wine
Sarah E. Mayfield, Renee T. Threlfall*, Luke R. Howard, John R. Clark, and Nathan B. Stebbins

Survey of Grapevine Viruses in Missouri Vineyards
Dean S. Volenberg*, James E. Schoelz, Vicki Klaassen, and Maher Al Rwahnih

Student Oral Presentation Competition (15 minutes each)

9:15-10:00 am

Optimize Cluster Exposure to Improve Grape Composition and Health
Silvia Liggieri, Tony K. Wolf*, and Misha Kwasniewski

Evaluating the Selectivity and Suitability of Nanofiltration-Resin (NF-R) Treatment for Production of Neutral Wines from *Vitis labruscana* Juices

Demetra M. Perry, Elizabeth J. Brown, Madison L. Marshall, and Gavin L. Sacks*

Characterization of Anthocyanin Profiles of Interspecific Red Hybrid Grapes

Sara M. Wagner and Anna Katharine Mansfield*

Break/View Posters

10:00-10:30 am

Student Oral Presentation Competition (15 minutes each)

10:30-11:15 pm

Retrofitting Vertically Shoot-Positioned Petit Manseng to Improve Vineyard Crop Yield
Rachael White*, John Scaduto, and Cain Hickey

Multiple Phenotyping Methods Find QTL for Berry Color in an Interspecific Hybrid Grape (*Vitis* spp.) Population
Anna Underhill and Matthew Clark*

Early Season Source-sink Modulation in Merlot (*Vitis vinifera* L.) Enhances Fruit Quality through a Shift in the Flavonoid Metabolome

Joshua VanderWeide*, Zhongli Ma, Tommaso Frioni, Patrick Murad, and Paolo Sabbatini

ASEV-ES Distinguished Service Award

11:15 am-12:00 pm

Joseph A. Fiola, Western Maryland Research and Education Center

Lunch Own Your Own

12:00-1:30 pm

Industry Workshop

1:30-5:00 pm

Moderators: Denise Gardner, Denise Gardner Wine Consulting and ASEV-ES Chair & Michela Centinari, Penn State

Taming High pH in the East

Presentations, Interactive Discussions, and Tastings

This workshop is sponsored by the Pennsylvania Wine Marketing & Research Program Board and features speakers that will discuss the challenges of working with wine grape cultivars with high pH issues.

Potassium's Conflicted Personality in Grapevine Nutrition

1:30-2:30 pm

Tony Wolf, Virginia Tech University
Fritz Westover, Westover Vineyard Advising, LLC

Acid Matters, Getting the Balance Right

2:30-3:30 pm

Geoff Cowey, Australian Wine Research Institute

Break/View Posters

3:30-4:00 pm

Optimizing Wine Color and Mouthfeel under High pH Conditions

4:00-5:00 pm

James Kennedy, Constellation Brands, Inc.

Panel or Open Question Session

5:00-5:30 pm

View Posters

5:30-6:00 pm

Adjourn

6:00 pm

Sparkling Wine Reception

6:30-7:00 pm

ASEV-ES Grand Awards Banquet

7:00-9:00 pm

Donation of Wine Glasses for ASEV-ES Banquet
ARTon Products



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Workshop Speakers

Geoff Cowey is the Senior Oenologist at The Australian Wine Research Institute (AWRI). He has twenty years' experience in winemaking, wine research and wine education roles. Cowey has degrees in Chemistry, Pharmacology, Winemaking, a WSET diploma and has worked harvests in most Australian wine regions as well as in France, Spain and New Zealand. Cowey manages a national helpdesk service at the AWRI where he provides technical advice to grapegrowers and winemakers to help solve production issues and provide support for best practice wine production. He translates research outcomes into practical advice and applications that can be easily and rapidly adopted by winemakers. Cowey writes regular columns for Australian and New Zealand Grapegrower & Winemaker, Australian and New Zealand Wine Industry Journal and AWRI *Technical Review* and develops web content, on-line tools and fact sheets for the AWRI website. He has lectured at The University of Adelaide, University of Conegliano, The University of Chile, The Wine Spirit & Educational Trust (WSET), The Institute of Masters of Wine, The Interwinery Analysis Group (IWAG), Australian Society for Viticulture and Oenology and Australian Wine Industry Technical Conferences. Cowey has judged at several National and International wine shows. Research interests have included wine flavour and sensory analysis, taints and faults, smoke taint, wine instabilities, Dekkera/Brettanomyces yeast spoilage, wine salinity, wine closures, climate adaptation and adoption behaviour of farmers.



James Kennedy is currently President of Polyphenolics and Canandaigua Concentrate, divisions of Constellation Brands. Prior to this, Kennedy was Professor and Chair of the Department of Viticulture and Enology, and Director of the Viticulture and Enology Research Center at California State University, Fresno. In addition to this, Kennedy has held positions as the Research Manager for Chemistry at the Australian Wine Research Institute, Associate Professor of Food Science and Technology at Oregon State University and a Fulbright Scholar at the University of Bordeaux. Dr. Kennedy is most widely recognized for his research on improving our understanding of grape and wine phenolic chemistry, with the primary goal being the improvement of red wine quality. Of specific interest for Kennedy is how grape and wine production practices influence red wine tannin composition and quality. Dr. Kennedy has published extensively as an author or co-author in peer-reviewed journals, grape and wine industry publications, and proceedings.



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.



Tony Wolf is a professor of viticulture at Virginia Tech where he has been employed since 1986. His viticulture education includes a MSc from the Pennsylvania State University and a PhD from Cornell University. Dr. Wolf has conducted research to expand the grape varietal landscape in Virginia, to better understand the adaptation of grapes to Virginia's biotic and abiotic challenges and, through collaboration with enologists, to improve grape and wine quality potential. Graduate student training has been an integral part of his research program. Dr. Wolf's extension program comprises workshops, development of web-based decision support tools, and publication of technical print and online media. Dr. Wolf has served as an Associate Editor of the American Journal of Enology and Viticulture, and has served as a director, secretary, and chairman of the American Society for Enology and Viticulture's Eastern Section. He has authored over 50 scientific papers and was senior author of the Mid-Atlantic Winegrape Growers Guide (1995), and was a principal author and editor of the Wine Grape Production Guide for Eastern North America (2008). His awards include Virginia Tech's Alumni Award for Extension Excellence (2009), Virginia Tech's College of Agriculture and Life Science's "Andy Swiger Land Grant Award" (2011), and the ASEV/Eastern Section's "Outstanding Achievement Award" (2017). In addition to his viticulture research and extension roles, Dr. Wolf teaches an online viticulture course and serves as Director of Virginia Tech's AHS Jr. Agricultural Research and Extension Center in Frederick County Virginia.



2018 ASEV-ES Outstanding Achievement Award

Dr. Terry Acree
Professor, Cornell University



2017 ASEV-ES Distinguished Service Award

Dr. Joseph A. Fiola
Principle Agent and Extension Specialist, Western Maryland Research and
Education Center



About ASEV-Eastern Section

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




EASTERN SECTION

Established 1975

AMERICAN SOCIETY FOR ENOLOGY & VITICULTURE - EASTERN SECTION

2018 SCHOLARSHIP FUNDRAISER RAISED \$14,000



Scholarship Donors

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The ASEV-ES works every year to raise scholarship funds for students working toward careers in viticulture and enology. ASEV-ES raised \$14,000 in 2018 scholarship fundraising events. ASEV-ES raised money at the Live and Silent Auctions at the Eastern Winery Exposition. Thank you to Eastern Winery Exposition, Wines & Vines, Wine Industry Suppliers, and Auction Bidders.

Donate online to the ASEV-ES scholarship fund at www.asev-es.org/PaypalASEVES.php

SAVE THE DATE: 43rd Annual ASEV-ES Conference
King of Prussia, PA - July 9-11, 2018

CONTACT ASEV-ES: 479-575-4677
OR INFO@ASEV-ES.ORG

2018 Scholarship Recipients



Mani Awale, University of Missouri

Andrea Barker, Brock University

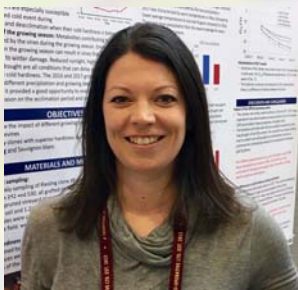
Andrew Harner, Penn State University

Suzanne Fleishman, Penn State University

Alex Fredrickson, University of Missouri

Anne Kearney, Cornell University

Silvia Liggieri, Virginia Tech



Student Presentation Competition Abstracts

The Effect of Grapevine Clone on Vine Performance, Fruit Composition and Oenological Potential for Core-Ontario Varieties

Andrea Barker*, James Willwerth, Belinda Kemp, and Debra Inglis

*Corresponding author: Brock University, 1812 Sir Isaac Brock Way, St. Catharines, ON L2S 3A1, Canada, ab16st@brocku.ca

Previous research has demonstrated that the effect of grapevine clone selection is region-specific. Consequently, it is imperative for the Ontario wine industry to have locally-relevant information. The objective of this research is to determine the influence of clone selection on vine performance, fruit composition and oenological potential for core Ontario varieties: Pinot noir (clones: 113, 114, 115 and 777) and Chardonnay (clones: 548, 96, 95 and 76). Replicated blocks for each cultivar by clone combination on common rootstock were established in commercial vineyards within the Niagara region. Vine performance was measured by timing of phenological stages, disease incidence, vigour and yield. Fruit composition was determined by measuring acid content, soluble solids and yeast assimilable nitrogen (YAN) in juice. Fruit was harvested from each research block and fermented into wine to evaluate oenological potential through fermentation kinetics and chemical composition. Preliminary analysis of results from the 2017 growing season indicate differences between Pinot noir clones, where clone 113 had lower cluster numbers and higher cluster weight than other treatments ($p < 0.0001$). Similarly, clone 113 had higher soluble solids than clones 114 and 115 and lower titratable acidity than clones 114 and 777 ($p < 0.05$). For Chardonnay, clone 548 had greater cluster numbers and lower cluster weights than other clones whereas clone 96 had higher cluster weights ($p < 0.05$). Grape must analyses indicated that clone 96 had higher pH than other clones and 548 had higher juice YAN levels than all other clones ($p < 0.05$). Differences in levels of YAN in grape musts had some impact in fermentation kinetics. Sensory analysis will be conducted on finished wines to determine clonal impact on aroma and flavor attributes. More research is required over multiple vintages in order to further understand clone effects in Ontario vineyards.

Utilization of Remote Sensing Technology to Detect Riesling Vineyard Variability

Briann Dorin*, Andrew Reynolds, Hyun-Suk Lee, Adam Shemrock, Ralph Brown, and Marilyne Jollineau

*Corresponding author: Brock University, 1812 Sir Isaac Brock Way, St. Catharines, ON L2S 3A1, Canada, bd16he@brocku.ca

A single vineyard block can vary spatially with respect to several important grapevine and berry qualities. With modern remote sensing technologies, remote sensing could be used to detect this vineyard variation both efficiently and affordably. Remote sensing, the science of obtaining information about objects or areas from a distance, was used to collect electromagnetic reflectance from six Riesling commercial vineyard blocks in Ontario, Canada. This project implemented two recently introduced remote sensing technologies; ground-based and unmanned aerial vehicles (UAVs). The hypothesis was that vineyard zones based on remotely sensed data would correspond to zones differing in the quality of several agriculturally significant variables such as vine water status, virus infection, yield, berry composition, and winter hardiness. In 2016, zonal maps created from remotely sensed data demonstrated similar spatial configurations to maps of yield, vine size, berry weight, water status, and berry composition. Spatial zones corresponding to high remotely sensed data were associated with zones of high vine water status, vine size, yield, titratable acidity and low berry sugar and terpene concentration. Both the ground based and UAV technologies detected similar zones, however, the ground based data provided more significant relationships with agricultural data compared to the UAV. Direct positive correlations were observed between remotely sensed data vs. vine size, leaf stomatal conductance, total yield, berry weight, and berry acidity and inverse correlations with berry sugar and terpene concentration. Ultimately, remote sensing demonstrates the ability to consistently detect vineyard zones differing in several important agricultural variables.

Controls on Grapevine Vigor: Decoupling Cover Crop Competition and Rootstock

Suzanne Fleishman*, Michela Centinari, and David Eissenstat

*Corresponding author: Pennsylvania State University, 107 Tyson Building, University Park, PA 16802, USA, suf44@psu.edu

Under-vine cover crops and rootstock selection have the potential to desirably reduce excessive grapevine vegetative growth. Inconsistent reports of the magnitude of reduction may be explained through mechanisms of belowground competition. Over the 2017 season in a Noiret (*Vitis* hybrid) vineyard in Pennsylvania, we examined above- and belowground responses of vines to competition with a perennial under-vine cover crop (*Festuca rubra*) when grafted to a low vigor (*Riparia Gloire*) or medium vigor rootstock [101-14 Mgt (*V. riparia* x *V. rupestris*)]. The growing season was wet; rainfall accumulated from May to October was 518 mm and vine water status ($\bar{\Psi}_{predawn}$) was never at stress levels. Yield was similar amongst treatments (3.9-4.5 tons/acre, $P=0.126$) but cover crop competition significantly reduced multiple measures of vegetative growth. Our data suggest a greater growth reduction for the medium vigor rootstock; in the presence of cover crop, pruning weights decreased by 40% for the medium vigor rootstock and 21% for the low vigor rootstock ($P = 0.092$). While rootstock did not influence root distribution, grapevine roots without cover crop were primarily (47%) between 0 and 20 cm, while roots with cover crop were primarily (41%) between 20 and 40 cm. This shift of roots to deeper, low-nutrient soil resulted in reductions in vine tissue nutrient (NPK) content ($P < 0.05$), however the relationship to soil water use was unclear. This study suggests that in a wet year, a medium vigor rootstock may be more sensitive than a low vigor rootstock to belowground competition by cover crops.

Sponsor of Best Student Enology Presentation
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Student Presentation Competition Abstracts

Isolation of Dehydrin Proteins in Dormant Buds of *Vitis vinifera* cv. Riesling and Sauvignon Blanc

Andréanne Hébert-Haché*, James Willwerth, Belinda Kemp, and Debra Inglis

*Corresponding author: Brock University, Department of Biological Sciences, 1812 Sir Isaac Brock Way, St. Catharines, ON L2S 3A1, Canada, ah10uq@brocku.ca

Grapevines can supercool, preventing intracellular water from freezing. The dehydrin-family of protein has been linked to this ability in other plants, and an increased concentration has been associated with enhanced cold hardiness. Dehydrins are highly hydrophilic proteins in the late embryogenesis protein-family with a C-terminus consensus sequence that is conserved across the plant kingdom. Genome analysis in recent studies have predicted the presence of several dehydrin proteins. Further immunoblotting assays have isolated four dehydrin proteins in the skins of grapevines under dehydration and cold stress. The goals of this research were to determine if (1) dehydrins are present in dormant grapevine compound buds, (2) monitor their change in concentration throughout dormancy and (3) their concentration is correlated to intra and inter-cultivar cold hardiness differences that were previously reported for the 2016-2017 dormant season. To achieve this, Riesling and Sauvignon blanc canes were collected regularly during the dormant season to obtain buds for cold hardiness determination and protein extraction. Bud hardiness was determined by differential thermal analysis (DTA) and vine balance was determined using the Ravaz Index. A semi-quantitative immunoblot assay was developed to compare the relative concentration of dehydrin proteins in the dormant buds. Preliminary results revealed the presence of three dehydrins with molecular weights of approximately 20 kDa, 60 kDa, and 65 kDa. The 20 kDa and 60 kDa dehydrins were isolated in the Riesling and Sauvignon blanc clones tested. A third 65 kDa dehydrin appeared sporadically in Riesling clones without correlation to differences in cold hardiness between clones. Dehydrin concentration in the total protein extract decreased towards deacclimation, indicative of its significance in dormant tissues. This work will contribute to our understanding of cold hardiness by isolating a new metabolite in dormant grapevine tissue.

Do Climatic and Viticultural Factors Influence Rotundone Accumulation in Noiret Wine Grapes?

Andrew Harner, Michela Centinari*, Ryan Elias, Bryan Hed, and Justine Vanden Heuvel

*Corresponding author: Penn State University, 218 Tyson Building, University Park, PA 16802, USA, mzc22@psu.edu

Rotundone is a grape-derived sesquiterpenoid responsible for the black pepper aroma of several wine grape cultivars, including the interspecific hybrid Noiret. To evaluate how climate and viticultural factors affect rotundone accumulation in Noiret berries, we compared fruit-set leaf removal to undefoliated control treatments for two years (2016-2017) at 7 Noiret vineyards across New York and Pennsylvania with considerable climatic variability. Vineyard mesoclimatic (photosynthetically active radiation (PAR), air temperature, and rainfall) and fruit-zone microclimatic (PAR and air temperature) parameters were assessed in both years. At each site, vine nutrient and water status, yield parameters, fruit chemistry, and pruning weight were also measured. Season-long growing degree days (GDD's) were higher in 2016 than in 2017 across all sites; however, all sites except one exhibited higher veraison-to-harvest temperatures in 2017. At 5 out of 7 sites rainfall was higher in 2017 (in some cases by 154 to 268%) than in 2016. Vintage had significant effects upon vine water status and total soluble solids, while site had significant effects for crop load and leaf petiole potassium concentration. Rotundone was extracted from grapes harvested at each site, and the samples are currently being analyzed at the Australian Wine Research Institute. A predictive model based upon rotundone concentrations and the other measured variables will be built using an all-possible regressions approach to identify the factors that most strongly influence rotundone concentration in Noiret berries. The model can assist growers to manipulate rotundone concentration through management practices and identify sites for their potential to produce peppery wines.



Student Presentation Competition Abstracts

Modifying Shoot Tip Management to Reduce Lateral Emergence and Cluster Compaction in Cabernet Franc

Anne Kearney, Justin France, and Justine Vanden Heuvel*

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Vigorous Cabernet Franc grapevines were subjected to shoot wrap, shoot tuck, and hedging (control) at each of two phenological stages (when shoots were 30 or 90 cm above the top catchwire). Lateral emergence in the fruit zone of the canopy was reduced from 32.8 to 18.4 lateral shoots per vine in 2017 by the shoot wrap technique compared to control. Cluster compaction was reduced in 2016, a dry year, from 6.5 to 4.7 berries per cm of rachis by the shoot wrap technique when applied at timing 1. In 2017, cluster compaction was reduced from 11.4 to 9.0 berries per cm of rachis in the shoot wrap technique regardless of timing. Incidence of downy mildew at the top of the canopy was high but did not differ among treatments. The decrease in cluster compaction suggests potential differences among treatments in timing of cluster closure, which may impact disease incidence in high-pressure years.

Optimized Cluster Exposure to Improve Grape Composition and Health

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By increasing fruit exposure to sunlight and influencing fruit development, leaf thinning in the fruit zone can improve grape quality and lower disease incidence; however, further investigations on the timing, varietal response and intensity are needed to optimize results and to better understand underlying physiologic responses. Fruit zone leaf thinning was applied at different timing and intensities to two varieties to evaluate its effect on cluster disease incidence and fruit composition at harvest. Control (C), pre-bloom defoliation (PB) and two levels of fruit-set defoliation (three leaves, PF3 and six leaves, PF6) were applied to Chardonnay. In a second vineyard, the effect of canopy height was also included: control (C), leaf thinning at fruitset (LT), hedging at the 12th node (H), and LT+H were applied to VSP-trained Cabernet Sauvignon. In Chardonnay, all thinning treatments reduced both disease incidence and severity to a comparable extent (avg. 80%) compared to control vines. PB reduced yield, and reduced cluster compactness by decreasing the number of berries per cluster. Treatments did not affect primary fruit chemistry, but PF6 significantly increased the grape content of free volatiles (IDN by 62% and β -damascenone by 31%) at harvest compared to the other treatments. In Cabernet Sauvignon, hedging did not increase sunlight availability in the fruit zone. Yield was unaffected by the treatments, and LT decreased cluster disease incidence by 59%. Looking at main effects, hedging reduced pH values and Brix at harvest, and negatively influenced anthocyanin accumulation (0.99 vs. 1.18 mg/g berry in H and not-hedged, respectively). By contrast, leaf thinning increased anthocyanins accumulation at harvest compared to non-defoliated vines. No interaction was found between H and LT.

Evaluating the Selectivity and Suitability of Nanofiltration-Resin (NF-R) Treatment for Production of Neutral Wines from *Vitis labruscana* Juices

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V. labruscana grapes (e.g. Concord) are generally unsuitable for use in premium red wines due to their characteristic “labrusca-type”, or “grapey” and “foxy” aromas. We hypothesized that the pre-fermentation treatment of *V. labruscana* juices by nanofiltration followed by a hydrophobic resin should result in selective removal of labrusca-type aromas without loss of color or other chemical changes, and without affecting fermentation kinetics. Using a bench scale nanofiltration-resin (NF-R) unit, Concord juice was processed in 4 L batches. After seven hours of juice processing, the key labrusca-type odorant, methyl anthranilate (MA), was reduced by 90% ($p < 0.05$), while other juice components (total anthocyanins, pH, total soluble solids, titratable acidity) were not significantly affected. Fermentation kinetics of these processed juices were similar to those of untreated juices. We propose that NF-R treated *V. labruscana* juices can be used as a low cost source for producing neutral red wines, especially in regions where production of standard red *V. vinifera* varieties is expensive or impossible.

Characterization of Anthocyanin Profiles of Interspecific Red Hybrid Grapes

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While *Vitis vinifera* grapes produce only monoglucoside anthocyanins, dominated by malvidin-3-glucoside, interspecific hybrid grapes show greater variety in both glycosylation and root anthocyanindins. Because base anthocyanindins affect hue of pigment and degree of glycosylation affects the stability of color over time, the anthocyanin profile of a grape will ultimately affect the resulting wine's color. To better understand the diversity of anthocyanins found in non-*vinifera* species, the anthocyanin profiles of six interspecific hybrid grape cultivars grown in New York state were characterized via HPLC. Eight grape cultivars, six interspecific hybrids and two *Vitis vinifera*, were sampled after reaching maturity their skins prepared for extraction by freeze drying and grinding with a ball grinder. The powered grape skins were extracted with a two-step methanol solution sonication method and the anthocyanins were separated using an Oasis carbon cartridge, dried, then resolubilized in acidified water. Anthocyanin samples were analyzed using an HPLC with a PFP column. The chromatograms of the grapes sampled were compared to those of anthocyanin standards and average profiles developed for each cultivar. Hybrid grape cultivars were found to have profiles that varied in general from *Vitis vinifera* grapes. Varieties that were closely related also had similarities in their anthocyanin profiles. These profiles will give insight to researchers in creating better winemaking practices for red hybrid grapes and grape breeders when developing new varieties.

ASEV-ES Conference Planning in Pennsylvania
Denise Gardener, Denise Gardener Consulting

Student Presentation Competition Abstracts

Retrofitting Vertically Shoot-Positioned Petit Manseng to Improve Vineyard Crop Yield

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The vertical shoot-positioned (VSP) training system is a single-canopy system commonly used for wine grape production. The VSP system, however, confines leaf area and fruit production between trellis catch wires typically spaced 15 cm apart. Fruit production and exposed leaf area are thus space-limited in that system; the result is modest crop yield in cultivars such as Petit Manseng. This study investigated the effects of retrofitting an already-established VSP trellis in a Petit Manseng vineyard by comparing (1) a split versus single canopy training system, and (2) single or double cane pruning versus spur pruning. It was hypothesized that the split canopy would hasten the rate of soluble solids accumulation and that double cane pruning would increase crop yield. The split canopy trellis increased pruning weight by 38% when compared to the single canopy; spur pruning increased pruning weight by 20% and 41% when compared to cane and double cane pruning, respectively. Double cane pruning increased crop yield by an average of 44% when compared to spur and cane pruning. Double cane pruning produced a crop load of 13.6, which was an average of 55% greater than crop loads observed in spur and cane pruning plots. Treatment did not affect soluble solids accumulation rate or harvest values.

Titrate acidity at harvest was greater in the split when compared to single canopy plots, and in the double cane when compared to spur pruning plots. While we question if relatively high crop load will limit crop production over time, our first-year results show that retro-fitting a VSP system through double cane pruning is a fiscally-judicious practice to increase crop yield in Petit Manseng.

Multiple Phenotyping Methods Find QTL for Berry Color in an Interspecific Hybrid Grape (*Vitis* spp.) Population

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Grape (*Vitis* spp.) berry color is determined primarily by polyphenolic compounds called anthocyanins, which are responsible for the spectrum of red to black appearance depending on the molecule's structure and the pH of the berry; absence of anthocyanin results in white berries. The genetic basis of berry color has been well-documented in terms of Mendelian inheritance between black, red, and white classes; however, the qualitative aspect of color is less understood. Many studies of berry color have focused on the *V. vinifera*, and results may not translate to diverse hybrids that include North American *Vitis* species like *V. riparia*, *V. aestivalis*, and *V. labrusca*. Two University of Minnesota breeding selections ('MN1264' × 'MN1246') with diverse interspecific parentage were crossed to create an F1 population (n = 123) with a range of berry colors that was phenotyped using 3 different methods: image analysis, high performance liquid chromatography-mass spectrometry (HPLC-MS) anthocyanin quantification, and a handheld color sensor. Data from each method was used in a quantitative trait loci (QTL) mapping experiment to validate known QTL associated with berry color. Each method returned a major QTL on chromosome 2 potentially associated with the *VvMybA* gene family, which is known to be involved in regulating anthocyanin production. In addition, major QTL were found on chromosome 6 – potentially corresponding to the *VvUFGT* gene, which codes for an enzyme related to anthocyanin synthesis – and chromosome 15. This research further elucidates the quantitative nature of berry color in an interspecies hybrid population and supports marker-assisted breeding efforts.

Early Season source-sink Modulation in Merlot (*Vitis vinifera* L.) Enhances Fruit Quality through a Shift in the Flavonoid Metabolome

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Removal of basal leaves early in grapevine vegetative development limits assimilation of carbohydrates to florets, reducing fertilization, and the number of berries per cluster. This subsequently controls vine yield, improving fruit quality. Mechanization of this practice can save time and money for growers, but has not yet been compared with manual application in cool climate growing regions where adequate seasonal temperature accumulation is a major limitation for yield and fruit technological maturity at harvest. The goal of this study was to compare mechanization of leaf removal with manual removal of 6 leaves at the pre-bloom (EL17) and after-bloom (EL27) phenological stages against a control (removal at veraison) over two seasons. Results indicate that mechanical treatments removed less leaf area than manual ones at each timing, leading to lower lateral compensation, and poorer fruit-zone microclimate conditions. Despite this, fruit set was decreased more in mechanical treatments at each timing. Photosynthesis data collected showed a strong compensation in Phi2 (quantum yield of Photosystem II) in the apical leaves of vines subjected to pre-bloom treatments. Additionally,

the NPQt (non-photochemical quenching) parameter was significantly pronounced in the medial and apical leaves of both manual treatments, indicating severe stress conditions in the leaves not related to weather conditions. Compared to manual treatments, berry sugar concentration was higher due to mechanization, while total acidity was decreased only in manual treatments. Furthermore, metabolomics analysis revealed a significant increase in anthocyanin and flavonol compounds in the pre-bloom mechanical treatment in both experimental years (2016 and 2017). Enhanced fruit quality from the mechanical treatments proved to be the result of a fruit-zone that received adequate light and temperature exposure early in development, but that retained significantly more leaf area to influence ripening after veraison. This information provides an important strategy to ripen red *vinifera* cultivars in cool climates.



Technical Session Abstracts

Influence of Flash Détente Technology on the Quality of Black Spanish Wines in Texas

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The Texas wine industry has seen an exponential growth over the last ten years, however one of its limiting factors is the high disease pressure which is increased by the high relative humidity of air. One disease in particular – *Xylella fastidiosa* (also known as Pierce's Disease) is forcing grape growers to plant hybrid varieties that are resistant to it rather than *vinifera* varieties that are not. One of the most popular hybrids planted in Eastern Texas is Black Spanish. In an effort to improve winemaking techniques for this varietal, we investigated the use of Flash Détente technology on the quality of Black Spanish wines. We produced three different wines: Control – non Flash Détente, Treatment - Flash Détente + Enartis protocol and Treatment 2 - Flash détente + minimum interventions and recorded their physico-chemical parameters as well as their color parameters. Sensory analysis of the wines was also performed. Results are currently being analyzed and will be presented in the paper. Preliminary data indicate clear differences in the color and mouthfeel of the wines as well as in their aroma profiles.

Pruning Approaches to Revive Cold Injured Merlot Grapevines

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In cool climate regions, some of the older vineyards have experienced repeated cold injury, reducing their productivity. During 2014-16 a field trial was conducted in an own-rooted Merlot vineyard in Eastern WA, planted in 1981 to test the potential of various pruning methods to revive cold-injured vines. Treatments were: 1) Standard spur pruning (control); 2) Modified kicker cane – 3 short canes were trained onto the cordon while the remainder of the cordon was disbudded; 3) Disbudding – all buds were removed from the cordon; 4) Chopped cordon – the cordon was removed by cutting the trunk 10-15 cm below the cordon wire, and one strong sucker was trained onto the wire to reestablish the cordon. In 2014 shoot growth and periderm formation were the highest in 'chopped cordon' indicating the fastest vegetative recovery, albeit with no crop. The three-year average yield (3.9 kg/vine) as well as cumulative yield (11.8 kg/vine) in 'kicker cane' was significantly higher than in other treatments. Pruning weight measurements indicated that 'kicker cane' had higher vigor compared to 'standard spur' and 'disbudding'. In 2016 the yield to pruning weight ratio for 'kicker cane' (6.3) was in the recommended range (5-10) while for other treatments, was under 5. Overall fruit composition remained similar in all four treatments during all three years, except for a slight increase or decrease in soluble solids, titratable acidity, or pH, only in one year. Observations indicate that 'kicker cane'

has potential to revive cold-injured declining vineyard while ensuring higher economic returns.

Crop 'til You Drop? Acidity not Linearly Correlated with Yield for 'Frontenac' Grapevines

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In North Dakota, due to the combined brevity of growing season and the threat of extreme winter temperatures, the grape and wine industry must choose between production goals of yield and quality using only information developed for cultivars grown in distinctly different viticulture environments. To explore the linear relationships between yield, grapevine health, and fruit quality, yield reducing treatments were applied to a mature, experimental vineyard planting of the red wine grape 'Frontenac' trained to three trellis/training systems: Geneva double curtain (GDC), high-wire (HW), and mid-wire cordon with a vertical shoot positioning system (VSP). Achieving a gradient of yields representative of commercial production in the Upper Midwest, manual shoot-thinning conducted on June 9, 2017 removed active growing shoots prior to fruit set. Postharvest examination revealed that of the technological maturity parameters monitored only soluble solid content (SSC), the quantity of sugar within juice, was linearly correlated with yield. A two-variable model composed of yield and trellis/training system suitably estimated juice sugar content as follows: using GDC as the reference trellis/training system, $SSC = 25.45 + 0.65 (HW) - 1.49 (VSP) - 0.22 (Yield [kg])$ (Adjusted $R^2 = 0.34$). Titratable acidity and pH were not significantly related to yield of the grapevine. Similarly, through the 2017-2018 winter, no consistent relationship was detected between crop level and cold-hardiness. This study will continue to be improved through further examinations developing a more thorough understanding of the relationships between yield, vine health, and fruit quality for 'Frontenac' grapevines grown in North Dakota.

Survey for Grapevine Leafroll Associated Viruses in Pennsylvania

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Grapevine leafroll disease (GLRD), caused by grapevine leafroll associated viruses (GLRaVs), is a very important disease of cultivated *Vitis* species worldwide. A survey of Pennsylvania wine grape vineyards was initiated in 2017 to determine the presence of GLRaVs and GLRD across the Commonwealth. Sample collection focused on four cultivars of *Vitis vinifera* (Cabernet franc, Pinot noir, Chardonnay, and Riesling) and one French hybrid cultivar, Chambourcin, that were deemed among the most important cultivars in the Pennsylvania wine grape industry. Petiole samples were collected during the ripening period from each of 42 vineyard blocks from 16 locations across the Commonwealth. Samples were collected from symptomatic and non-symptomatic vines, in a randomized manner, and analyzed for GLRaV-1 and 3 with enzyme-linked immunosorbent assay (ELISA; AgriTest). About 36% of the blocks tested positive for GLRaV 1 and/or 3. Fourteen percent of Chambourcin blocks and 39% of *V. vinifera* blocks sampled contained vines that tested positive for GLRaV 1 and/or 3. Amongst the *V. vinifera* blocks, 29, 38, 42, and 50% of the Riesling, Pinot noir, Chardonnay, and Cabernet franc blocks were positive for GLRaV 1 and/or 3, respectively. At one location where we were able to collect data on all four *V. vinifera* cultivars and where there were many vines positive for leafroll virus among all cultivars, there was good correlation among red varieties between vines that showed symptoms (red, curled leaves) and vines that tested positive. However, among white varieties (Riesling and Chardonnay) the correlation was poor.

Technical Session Abstracts

Fruit-Zone Leaf Removal Effects on Cabernet Franc Grown in North Carolina and Georgia.

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Recent studies conducted in the Mid-Atlantic US reported that zero fruit zone leaf layers produces generally positive responses in red winegrapes: no sunburn incidence (anecdotal), maintained or improved berry phenolics and anthocyanins, and/or reduced rot. By contrast, sunburn was observed, and anthocyanins reduced, in well-exposed red winegrapes in similar studies conducted in the western US. Optimal fruit zone management practice is thus region-specific. We evaluated leaf removal effects on Cabernet franc grown in the Yadkin Valley of North Carolina and in Tiger, Georgia—two regions anticipated to impose amplified heat load on grapes due to their southerly geographical position. Three leaf removal treatments were evaluated in generally north/south-oriented vineyards at both locations: pre-bloom or post-fruit set removal of six leaves (PB or PFS) and removal of no leaves (NO). Crop yield and components thereof were unaffected by treatment. Botrytis bunch rot incidence, which was evaluated only at the North Carolina site, was reduced by PB by 44% and PFS by 81% when compared to NO. PB reduced total titratable acidity by 7% when compared to NO in North Carolina, while both PB and PFS reduced total titratable acidity by an average of 14% when compared to NO in Georgia. Both leaf removal treatments increased total grape phenolics by an average of 25%, while only PB increased total grape anthocyanins by 14%, when compared to NO in Georgia. The west canopy side produced 9% greater anthocyanins than the east canopy side, and both PB and PFS increased phenolics by an average of 16% when compared to NO in North Carolina. This preliminary data shows that grapes produced without attendant shade may not limit the quality potential of Cabernet franc wines produced in the southernmost *V. vinifera* growing regions of the eastern US.

Evaluating the Effects of Under Vine Cover Crops on Noiret Vines in a Commercial Vineyard in New York State

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Maintaining a vegetation-free strip under vines is a conventional management practice in the Finger Lakes region of New York State. This practice, aimed at minimizing competition between weeds and vines, appears counterintuitive when considering the vigorous growth habits of many interspecific hybrid cultivars. The experiment was conducted in a commercial vineyard with shallow (~80 cm) soil. Five under-vine cover crop treatments were planted beneath Noiret vines and compared to a glyphosate-maintained herbicide strip during the 2015 and 2016 growing seasons. Chicory, fescue, alfalfa, radish, and mix (oat, pea, vetch, and fava bean) had no significant effects on vine growth or fruit composition in 2015. Due to severe drought and above average temperatures in 2016, two of the cover crop treatments (radish and mix) failed to re-establish. The remaining three treatments significantly reduced shoot length by up to 40%, reduced yield by up to 53%, reduced pruning weight by up to 45%, and increased juice soluble solids by up to 1.3 Brix compared to the control in 2016. Crop load was not affected in either year. Chicory, fescue, and alfalfa under-vine cover crops successfully reduced vigor in Noiret grapevines, but also reduced yield in a year with severe drought.

Impacts of Source-Sink Manipulations on Riesling Vines in 2017-2018

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Overcropping or undercropping vines are both thought by growers and researchers to influence winter bud hardiness and return crop in the following year. We experimentally defoliated, defruited, and severely shoot-thinned Riesling vines to produce extremes in leaf area:fruit ratios to investigate how these treatments would affect yield components, biomass production (pruning weights), fruit composition, winter bud hardiness, bud fruitfulness, and shoot growth in the following year. Vines defoliated at fruit set (D1x), defoliated at fruit set and at veraison (D2x), defruited (DF), and shoot-thinned to 8 shoots per vine (8-SH), were compared to standard cane-pruned VSP vines (Control). D1x and D2x reduced crop weight by 50%, but only the D2x treatment resulted in reduced soluble solids and higher bud freezing temperatures. D1x and D2x reduced pruning weights by 41% and 51%, while DF increased it by 20%. Individual cane length was similar for DF, control, and D1x treatments. The 8-SH treatment had ~19% lower pruning weight than controls, but individual canes were ~25% longer (~2.5M) than control vines (~2m). In a year with ample rainfall, only the twice defoliated (D2x) vines had reduced bud hardiness and increased bud mortality.

Evaluation of the Enological, Economic and Environmental Interest of the Use of Potassium Polyaspartate

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Ensuring tartrate stability is a requirement of the modern wine industry, as presence of any sort of sediment or haze in bottle is one of the first causes of rejection by the consumer. Several techniques are available to achieve tartrate stability in wine, however they all present limitations. Physical method such as traditional refrigeration, ion exchange resins and electro dialysis have high energetic and water cost, strong environmental impact, and require intensive labor. Additionally, chilling is time intensive and often reduce wine quality, ion exchange resins and electro dialysis require high capital investment. Metatartaric acid loses its activity after a few months, carboxymethylcellulose (CMC) has a long lasting effect on wines over time but affects color stability in red and rosé wines and mannoproteins have a variable effectiveness, high cost of addition and might impact filterability. Potassium polyaspartate (KPA) is a new colloidal stabilizer approved by the OIV (International Organization of Vine and Wine) for tartrate stabilization of wines that overpass all the limitations mentioned above. Recently approved for use in winemaking by the European Union, KPA is currently in process of approval by the Canadian and United States authorities. Trials were conducted to evaluate the stabilizing effect of Zenith® Uno and Zenith® Color, commercial preparations based of KPA, comparing to other treatments already in use at the winery for white, rose and red wines from different countries (Chili, France, Italy, South Africa, Argentina, etc.). This study includes results on stabilizing effect (tartare and color), wine quality impact as well as environmental and economic analysis.

Technical Session Abstracts

The Impacts of Frozen Material-Other-Than-Grapes (MOG) on Aroma Compounds of Red Wine Varieties

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An undesirable note called “floral taint” has been observed in red wines by winemakers in the Niagara region and elsewhere, caused by large volumes of frozen leaves and petioles [materials-other-than-grapes (MOG)] introduced during winemaking. The volatiles responsible, we hypothesized, are terpenes, norisoprenoids, and specific esters in the frozen leaves and petioles. Research winemaking was conducted in 2016 and 2017 based on 40-kg replicated fermentations of Cabernet franc (CF) and Cabernet Sauvignon (CS). MOG Treatments were (by weight): 0, 0.5%, 1%, 2% and 5% previously-frozen petioles, and 0.25%, 0.5%, 1%, and 2% leaf blades. In 2017, three different yeast strains (FX10, EC1118, CSM) and five harvest strategies [hand harvest, standard mechanical harvest (MH), MH + pre-harvest leaf removal, opti-harvest, MH + optical sorting] were also included in the CF treatments. Concentrations of key odor-active compounds were quantified by gas chromatography-mass spectrometry with stir bar sorptive extraction. Results showed that *cis*- and *trans*-rose oxides, β -ionone, citronellol, linalool, eugenol, methyl and ethyl salicylate were higher in MOG treatments for both CF and CS and their concentrations increased linearly with the accumulative level of petioles or leaves. Principal components analysis showed petiole and leaf treatments were separated substantially from the control sample with the 5% petioles and 2% leaves as the extremes. Petiole and leaf treatments were spread out on different axes, which indicated their large differences in volatile compositions. Interestingly, eugenol and both *cis*- and *trans*-rose oxides followed profoundly linear curves with addition of petioles and leaves in 2016 vintage, which could be potentially used as a tool to communicate with winemakers on potential floral taint risk based on their sensory thresholds. Preliminary results from 2017 showed that more terpene compounds were found in the standard MH treatment vs. hand-harvested control or opti-harvest, and FX10 yeast had lower terpene concentration than the others.

Comparing Response and Recovery to Post-budburst Freeze Stress of Two *Vitis* Species

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Two *Vitis* genotypes (*V. vinifera* Chardonnay and *Vitis* spp. La Crescent) that contrast in winter cold hardiness and date of budburst were evaluated for short-term physiological response and long-term recovery to post-budburst freeze stress (FS). Since increased size of xylem vessel elements is associated with greater risk of cavitation and subsequent loss of water transport from FS, we analyzed xylem structure of one-year-old cane tissue as a mechanism for potential species difference in FS response and recovery. In spring 2016, a controlled FS event was applied to 40 potted vines of each genotype following budburst, while 40 vines were maintained as a control (C). Short-term response was measured by stem-specific hydraulic conductivity (K_s), an indicator of water transport rate. Control La Crescent vines had four times higher K_s than Chardonnay vines. Twenty-four hours following FS, FS Chardonnay and La Crescent vines had 32.4% and 81.3% lower K_s than the C, respectively. Seventy-two hours following FS, K_s of FS Chardonnay was 85.7% greater than at 24 hours and 122.8% greater than the C. While vine genotypes did not differ in the average vessel diameter, La Crescent exhibited higher vessel frequency than Chardonnay, which may explain higher initial K_s of La Crescent vines. With regard to long-term FS recovery, both FS Chardonnay and La Crescent displayed rates of mid-season whole-plant hydraulic conductance and gas exchange rates similar to C. FS and C treatments did not differ in fall and mid-winter estimates of bud cold hardiness.

Vertical Airflow Technology for Cool Climate Appassimento Grape Drying

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Appassimento style wines are produced by drying grapes until up to 30% of their moisture is lost before crushing, yielding increased °Brix and more concentrated flavors. Appassimento offers winemakers in cool climate regions a useful technique for generating profitable premium category wines and mitigating year- to-year climate variations. The traditional method of drying grapes for Appassimento has been enhanced over time by employing various technologies, however, challenges persist. Insufficient or uneven airflow contributes to mould and loss of valuable crop, while the amount of floor space required can be prohibitive. A system using pressurized vertical airflow was conceived and tested/refined over harvests from 2011 to 2016 in the Niagara, Ontario region. The resulting technology has been patented and yielded a system and method for drying grapes that is cost effective and scalable to suit the needs of small to large wineries. Floor space requirements are reduced by up to 4x over traditional methods, while spoilage concerns are alleviated when suitable fruit is used in the process. Coupled with environmental control systems to regulate temperature and humidity, the drying time required to achieve a target °Brix level can be controlled and achieved reproducibly year after year. The system has already been adopted and successfully used by a number of Ontario wineries and shows great promise for use in similar cool climate regions such as the Eastern and Central US. This discussion will expand on the development process and results, technical aspects and implementation of the technology for successful Appassimento grape drying.

Evaluating Novel Hybrid Pierce's Disease Tolerant Winegrape Varieties on Three Training Systems in Georgia

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Pierce's Disease is a major limiting factor for production of European *Vitis vinifera* cultivars in most of Georgia and the southeastern US. The winegrape industry in Georgia is growing and demand for disease tolerant hybrid winegrape varieties has increased. The varieties 'Blanc Du Bois', 'Lenoir', 'Norton' and 'Villard Blanc' have been successfully grown in the southern US with tolerance to Pierce's disease and yield and wine quality comparable to *V. vinifera*; however, there is currently no information available for Georgia. The objective of this study was to evaluate these varieties for yield and fruit quality on three training systems: Geneva double curtain (GDC), vertical shoot position (VSP), and Watson High Cordon (WHC). Varieties were planted in 2013 at Trillium Vineyards (Bremen, GA) in a randomized complete block design, with three replicates and four vines per replicate. Data collection in 2015 and 2016 included yield (total cluster number/vine, average cluster weight, berry weight), fruit quality [°brix, percent total titratable acids (%TTA)]. For yield traits, variety overall, training system overall, and variety*training system impacted nearly all traits in both years ($P \leq 0.05$). The largest differences were observed for 'Blanc du Bois' and 'Lenoir', where GDC was approximately double the total cluster number in Watson and VSP in 2016. No differences were observed for all yield traits between the three training systems for 'Norton' and 'Villard Blanc' in 2016. This suggests training system affects yield traits on some varieties, but does not affect all varieties equally. For general fruit quality traits, results were variable across years and suggest that differences observed for %TTA and °brix are due to variety differences, while training system selection influences °brix. Production data will continue through 2018 and will include an economical evaluation of time requirements for labor for each training system and variety.

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Student Poster Competition Abstracts

Detecting Regionality of Pennsylvania White Wines with Consumers and Wine Professionals

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From Old World appellation systems to California's Napa Valley, wines exhibit regional and stylistic classifications to attract consumers. There is potential for local wine markets to use regionality to increase small-scale sales and wine tourism. An ongoing study on Pennsylvania wine regionality is looking at the differences between growing regions. The objective of this on-going study is to link regional Pennsylvania wine qualities in Riesling and Vidal Blanc wines to Pennsylvania wine consumers, as well as the winemakers themselves. Pennsylvania wine consumer hedonic scores and check-all-that-apply flavor attributes were compared to descriptive analysis data. Winemakers and wine professionals will complete a sorting task of the same wines this April, in order to link regionality detected by the trained panel to the perception of regionality by wine professionals from these regions. Pennsylvania wine consumers were able to detect some regional differences between the wines, though their perception and liking was mostly driven by wine sweetness levels. Wines with residual sugar were significantly higher in liking scores than dry wines ($P < 0.05$). The free sorting exercise with wine industry professionals from Pennsylvania will provide insight into how they perceive regional differences in white Riesling and Vidal blanc wines from Pennsylvania. We speculate that training and expertise will have an impact on the perception of regionality of white wines from Pennsylvania.

Evaluating Salt Exclusion and Alkaline Soil Tolerance of Muscadines and Bunch Grape Rootstocks

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Bunch grapes (*Vitis* spp.) are classified as moderately salt tolerant. However, little is known about the salt tolerance of muscadine (*Vitis rotundifolia*) grapes. The objective of this research was to evaluate the salt exclusion capacity and alkaline soil tolerance of muscadine grapes relative to common bunch grape rootstocks and own-rooted hybrids. In two separate greenhouse experiments, 33 muscadine, 6 bunch grape rootstock, and 3 own-rooted hybrid cultivars were irrigated daily with a 25mM NaCl salt solution for a period of 14 days and destructively harvested to determine Na⁺ and Cl⁻ concentrations in roots and shoots. At harvest, leaf necrosis was rated on a scale of 0 (0 = no necrosis) to 4 (4 = 76 -100% necrosis).

In experiment one and two, leaf necrosis ratings ranged from 0.17 to 2.08 and 0.08 to 2.33, respectively, across all cultivars. The highest ratings were observed in 1103 Paulsen (P), followed by Victoria Red. In both experiments the muscadine cultivars ranked lower than 1103P, Victoria Red, 420A, and 101-14 Millardet et de Grasset (Mgt). To evaluate the relative alkaline soil tolerance of muscadines, 33 muscadine cultivars, 6 bunch grape rootstock cultivars, and 3 own-rooted hybrids were evaluated under field conditions in an alkaline (pH 8.2) Weswood silt loam soil. At the end of the growing season, tissue samples were collected from each cultivar for nutrient analysis and visual ratings of leaf chlorosis were taken. The muscadine cultivars under study had lower tissue boron and sulfur, and higher tissue sodium, chloride, and iron than the bunch grape rootstocks.

Investigations into the Effect on Wine Tannin Following a Co-fermentation vs. Post-fermentation Blending of an Interspecific Hybrid and a *Vitis vinifera* Variety

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Grape growing for wine production has had considerable growth throughout the Midwest in the past two decades. Much of this wine is produced from interspecific hybrid grape varieties that were specifically bred for the regions cold winters. The sales of locally produced wine continue to be hampered by the inability to produce a red wine that has significant mouthfeel and structure. This is due to the lack of tannins in the final wines. To investigate the causes of low tannin in hybrid wines we prepared Marquette (low tannin)-Cabernet Sauvignon (high tannin) wine blends through co-fermentation and post-fermentation blending (ratios = 90:10, 75:25, 50:50). We observed non-ideal behavior (negative deviation from linearity) in final wine tannin when the two varieties were co-fermented. For example, a 50:50 co-fermented blend exhibited a wine tannin concentration of 1055 mg/L epicatechin equiv. as compared to the expected value of 1198 mg/L. By comparison, a post-fermentation blend of the separately fermented wines resulted in a final tannin concentration that did not differ significantly from the value expected based on a simple linear model (1142 vs. 1198 mg/L). We are currently investigating if the non-linear behavior of pre-fermentation blends of Marquette and Cabernet Sauvignon can be explained by high protein:tannin ratios in the hybrid variety.

Impact of Two Frost Avoidance Strategies on Chemical and Sensory Wine Quality - First Year Results

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Frost events are a major threat to grape growers, especially in Pennsylvania where these events can occur throughout the spring growing season. There are a few methods of frost avoidance that are typically used but they can be expensive and unfeasible. Among the most promising alternatives are those that delay bud break. In the first year of a multi-year study, two frost avoidance strategies (vegetable oil application at two concentrations and delayed pruning) were compared to a control treatment on Riesling and Lemberger (Blaufränkisch) grapes. Wines produced from these grapes were evaluated for quality with instrumental (volatile and non-volatile profiling) and sensory methods. In Riesling, the 4 treatments showed no significant differences in volatile composition, or non-flavonoid composition ($P > 0.05$). Sensory similarity could be concluded for all frost avoidance treatments when compared to the control ($n=105$ white wine consumers, =10%, =5%). In contrast, the Lemberger wines showed significant differences in several volatile compounds, including grape-derived Linalool and fermentation-derived octanoic acid ($P < 0.05$), with the delayed spur pruning wines being significantly different from the control treatment. The same was found with 113 red wine consumers in a sensory discrimination test: The delayed spur pruning wines differed significantly from the control but also the vegetable oil treatment ($P < 0.05$). Overall, these first results show that these treatments may or may not affect wine quality, therefore, multiple years of data are needed to develop recommendations for growers.

Student Poster Competition Abstracts

Early Season Leaf Removal Reduces Cluster Compactness and Yield in North Dakota 'Marquette'

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In North Dakota's extremely brief growing season, the grape and wine industries face annual challenges achieving acceptable fruit technological maturity. Little is known about the impacts of viticultural practices on ripening fruit or grapevine health in this underexplored cool-climate. To examine the effect of fruit zone leaf removal (LR) on ripening of 'Marquette', an interspecific hybrid red wine grape, a 3 × 2 factorial composed of 3 LR timings (trace-bloom [TBRL], fruit-set [FSLR], and onset of veraison [VRLR]) and 2 LR severities (50% and 100% fruit zone LR) was employed within an experimental plot located at a commercial vineyard near Buffalo, ND. For the 2017 growing season, cluster size, compactness, and subsequent yields were reduced with the two earlier LR timing treatments. VRLR treatments had the largest clusters and highest yields, while yield reductions of 22.7% and 27.2% were observed for TBRL and FSLR, respectively. Soluble solid content (SSC) accumulated with earlier LR treatments as exemplified by TBRL's 2.8 °Brix increase in SSC relative to VRLR. Acidity, as measured by titratable acidity and pH, was affected by neither LR timing nor severity. Interactions between LR timing and severity factors were not detected; only manual labor estimates were significantly different between the severity levels, with 100% fruit zone LR requiring an estimated 43.6% more labor hours per acre. Preliminary results of this ongoing study indicate grape growers in eastern ND may effectively manage yield while improving SSC through implementation of TBRL and FSLR.

Leaf Removal Timing and Extent Differentially Effect Crop Yield, Rot, and Fruit Composition in Georgia-Grown Chardonnay

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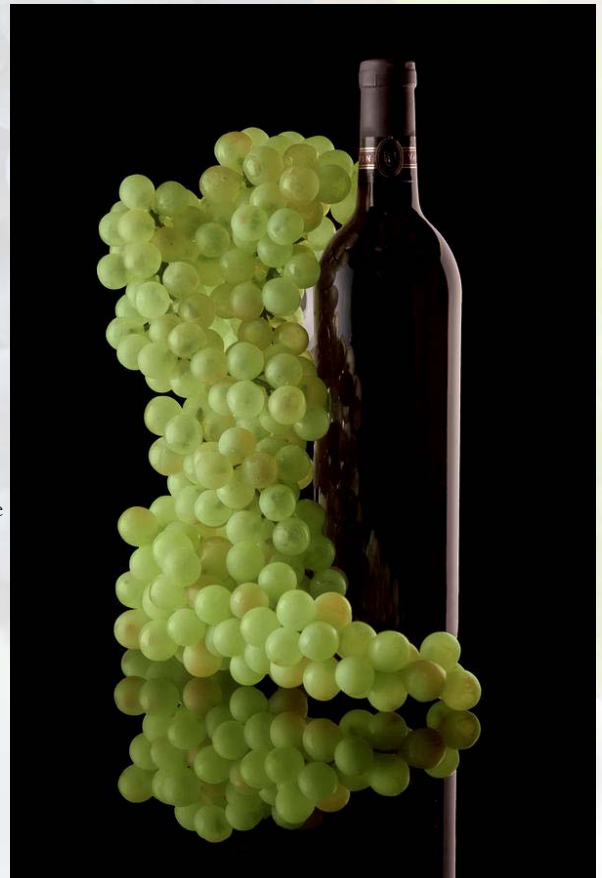
Fruit zone leaf thinning is a management tool used to reduce disease pressure and improve berry composition in vineyards. The attendant increase in fruit zone light and radiation with leaf removal can result in different responses across climatically-distinct regions. We were thus interested in evaluating leaf removal effect on Chardonnay grown in Dahunega, Georgia, a growing region void of previous viticulture research. Seven leaf removal methods were evaluated: pre-bloom removal of four or six leaves (PB4 or PB6); post-fruit set removal of four or six leaves (PFS4 or PFS6); pre-bloom removal of two leaves *and* post-fruit set removal of two leaves (PB2-PFS2); pre-bloom removal of three leaves *and* post-fruit set removal of three leaves (PB3-PFS3); removal of no leaves (NO). PB6 reduced crop yield by 34% compared to PFS4. Excepting PB6, leaf removal treatments reduced *Botrytis* bunch rot severity by 48-78% when compared to NO. Leaf removal treatment did not affect *Botrytis* incidence nor sour rot incidence and severity. NO reduced soluble solids by 0.7-1.0 degrees Brix when compared to all treatments excepting PFS4. All leaf removal treatments reduced total titratable acidity by 8-18%, and only PB3-PFS3 reduced malic acid, when compared to NO. Based on first-year results, post-fruit set leaf removal is recommended to maintain crop yield and reduce *Botrytis* in Chardonnay.

Characterization of Wine Regionality in Pennsylvanian White Wines with a Trained Sensory Panel

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Regional typicality of wines is an important concept for 'Old-World' wines, and is also a factor that consumers consider strongly when deciding to buy a wine. Previous studies have found regional typicality in wines made from the same cultivar even when originating from different regions. To test anecdotal evidence of regional typicality, specifically in Pennsylvania wines, in addition to furthering the reputation of Pennsylvania as a premium East Coast wine region, the following study was conducted: Sensory profiles (aroma, flavor, taste, mouthfeel, aftertaste) of 15 Riesling and 12 Vidal blanc wines from commercial producers in four different geographical areas within Pennsylvania (2-4 per region) were determined with a descriptive analysis panel (8 females, 1 male; 30-60 yrs.). Significant sensory differences in aroma, flavor, taste, mouthfeel and aftertaste attributes ($P < 0.05$) were found for both the Riesling and Vidal blanc wines. Wines from the same geographical region tended to group together, despite differences in winemaking and wine style. This grouping by region was more pronounced for Riesling wines than Vidal blanc wines, which could also be due to the lower number of Vidal blanc wines in the study. Based on these initial results, there seems to be some scientific evidence for wine regionality across different regions in Pennsylvania. Next steps are to validate and expand these initial findings by evaluating how stable these groups are across vintages and including additional Riesling and Vidal blanc wines from each of the regions.



Poster Session Abstracts

Effects of “Kicker” Canes on Yield and Dormant Pruning Weight in Chardonnay and Chambourcin varieties in New Jersey Hemant L. Gohil* and Daniel Ward

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In an attempt to reduce excess vine vigor, some extra unpruned canes were left on vines at the time of dormant pruning. These “Kicker” canes were retained then pruned off at bloom to evaluate their effects on yield and pruning weight in Chambourcin and Chardonnay in southern New Jersey, during a two-year study. Mature vines trained to a bilateral cordon VSP system were used for the experiment. Four treatments were applied; 1) no kicker canes retained, 2) one kicker cane at the distal end of each cordon, 3) one kicker cane at the proximal end of each cordon and, 4) one kicker cane each at the distal plus proximal end of each cordon. A completely randomized design was employed with four replicates of the four treatments. In Chardonnay, during both years yield and dormant pruning weights were comparable for all treatments. In Chambourcin, retaining two kicker canes reduced dormant pruning weight albeit significantly reduced yield in 2016. We detected no significant difference in dormant pruning weight among treatments in 2017, however retaining two kicker canes resulted in a significant reduction in yield. In summary, kicker canes have potential to reduce excess vigor in Chambourcin but it may also reduce yields.

Quantitative Method Validation for Dietary Flavanols with Different Degrees of Polymerization at Different Concentrations

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Dietary flavanols, which are abundant in grapes and wine, are currently being evaluated for their potential health benefits. Flavanols can exist in a variety of polymerization states, with the chain length expressed as “degree of polymerization” (DP). It is believed that the mean degree of polymerization (mDP), which can vary due to environmental and processing conditions, is directly related to the potential health benefits of flavanol-rich foods. A variety of analytical methods have been designed to characterize and quantify flavanols. The Folin-Ciocalteu (FC) and 4-dimethylaminocinnamaldehyde (DMAC) assays colorimetrically measure total polyphenols and total flavanols, respectively. Thiolytic is a quantitative UPLC technique based on a qualitative calculation to determine the mDP using a thiolytic reaction. The objective of this study was to evaluate the effect of DP on colorimetric assay response and the effect of concentration on the response of the thiolytic reaction. Flavanol standards ranging from monomer (DP1) to decamer (DP10) were analyzed by FC and DMAC at equal concentrations. It was observed that the response of the FC assay is not significantly affected by flavanol DP, while the response of DMAC for monomer flavanols is elevated compared to polymerized flavanols. Two flavanol-rich extracts were diluted to concentrations ranging from 0.5 to 1.0 mg extract/mL to determine if concentration affects calculated mDP as measured by thiolytic. It was observed in both extracts that calculated mDP was positively correlated with concentration, suggesting that thiolytic reaction kinetics do not increase proportionally with increasing substrate concentration. It is apparent that colorimetric assays for flavanol quantification should be selected based on whether the substrate is rich in monomeric flavanols or larger DP compounds, with FC being the preferred analysis when monomers are abundant. When determining flavanol mDP, substrate concentration during thiolytic must be considered.

New Tools for Vineyard Site Selection in the Lake Erie Region

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A traditional rule for site selection in the Lake Erie viticulture region holds that if one can see Lake Erie on the horizon from the vineyard site, it is likely a suitable spot for viticulture. Embedded within this principle is the notion that sites matching this description have sufficient elevation and proximity to the lake as to benefit from the thermal buffering and breeze systems created by Lake Erie (Kwiatkowski 1987). As part of a program known as the Ashtabula Terroir project, staff at the Ashtabula Agricultural Research Station have collected geolocations of points throughout Northeast Ohio from which one can view the Lake Erie horizon. The purpose of this exercise was not only to create a searchable map for prospective growers and wine marketers, but to assess the effectiveness of this site selection rule. This activity was carried out on a Samsung Galaxy S4 tablet, in the OSMTracker android application. Quantitative analysis of geospatial relationships is ongoing, but visual inspection has plainly revealed that the “Lakeview Rule” tends to favor sites adjacent to major North-South roads, presumably due to their lack of obstruction from treelines and built structures. In response, the researcher has created a novel, formula-based “Lakeview Index”, to capture the mathematical relationship between elevation and proximity to Lake Erie. As the project continues, the focus will shift to cross-verification of both resources, through the analysis of environmental data from on-site weather stations.

Replacing Herbicides with Groundcovers to Enhance Vineyard Sustainability

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In many Midwestern vineyards a three to four-foot weed-free strip is maintained directly beneath the vines to reduce vine-weed competition. Conventionally, this strip has been conserved with repeated applications of herbicide, mainly glyphosate. The necessity for this weed-free strip to reduce vine-weed competition has been well documented in more arid climates. However, in areas with higher soil fertility and adequate rainfall, this strip may be unnecessary. Moreover, stand establishment and early vine growth have not been well documented when planting groundcovers (GC) immediately following the vine planting. The main objective of this project is to assess the severity of competition for water between ‘Edelweiss’ grapevines and neighboring permanent GC treatments. In year one (2014), the vineyard and GCs were established, where the GCs were planted immediately after the vines. Midday leaf water potential (Ψ_{md}) measurements began in 2015 and lasted through 2017 to assess water competition between vines and GCs. Additional data collected during the four year project included: pruning weights, bud break, yield and fruit quality and soil nutrition. Generally, GC treatments had lower Ψ_{md} than the herbicide sprayed control, however, none of the treatments exhibited even slight water stress. Vine-GC competition was most apparent in the three years of pruning weights, where the most native grass GC treatment had up to 99% in 2014, 193% in 2015 and 183% in 2016 lower weights than the control. Harvest in 2016 and 2017 showed significantly lower yields between GC treatments and the control. However, no differences were found in berry quality (pH, Titratable Acidity, °Brix). An additional greenhouse project was done to define water stress thresholds for ‘Edelweiss’ grapevines using Ψ_{md} and high resolution thermal infrared images. Fully irrigated and 14-day dry vines exhibited a Ψ_{md} of -8.7 bars and -13.3 bars, respectively. The grapevines exhibited a mild, moderate and severe water stress level at 8, 10 and 12 days-dry, respectively (Ψ_{md} of -12 bars, -12.5 bars and -13 bars). Results suggest that

Poster Session Abstracts

Physiochemical and Descriptive Sensory Analysis of Arkansas-Grown Muscadine Grapes for Fresh Market

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The fruit breeding program at the University of Arkansas System Division of Agriculture is actively breeding muscadine grapes (*Vitis rotundifolia* Michx.) for fresh markets. The physiochemical and sensory attributes of the grapes were evaluated on three muscadine cultivars (Ison, Nesbitt, and Summit) and three advanced selections (AM-9, AM-74, and AM-83) from the Fruit Research Station in Clarksville, AR in 2017. The muscadine grapes at harvest had berry weights of 9.25-14.38 g, firmness of 0.89-2.14 N, soluble solids of 12.73%-15.40%, pH of 2.88-3.33, titratable acidity of 0.54%-1.01%, soluble solids/titratable acidity ratio of 13.12-28.49, total sugars of 6.17-9.75 g/100 g (glucose+fructose) and total organic acids of 0.50-0.84 g/100 g (tartaric+isocitric+malic acid). Eight trained descriptive sensory panelists established a lexicon for fresh-market muscadines including aroma (n=9), external appearance (n=10), internal appearance (n=3), basic tastes (n=3), aromatics (n=10), feeling factors (n=2), and texture (n=8) in duplicate using a 15-point scale (1 is less of an attribute and 15 is more). The descriptive sensory panelists differentiated among genotypes for external appearance, internal appearance, and basic taste attributes. 'Summit' and AM-74 had the highest grape/overall aroma (5.8-6.1), overall aromatic impact (8.3-8.4), and sweetness (7.6-7.9). Of the physiochemical attributes total sugars had the most significant correlations ($r=\pm 0.81-0.97$) with descriptive sensory attributes followed by soluble solids/titratable acidity ratio ($r=\pm 0.85-0.97$). Physiochemical and descriptive sensory analysis has potential to identify important attributes of fresh-market muscadine grapes.

Evaluation of Anthocyanins in Arkansas-Grown Enchantment Grapes and Wine

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Enchantment is a new *Vitis* hybrid wine grape developed by the University of Arkansas System Division of Agriculture. *V. vinifera* cultivars Petit Syrah, Alicante Bouschet, and Petit Bouschet and the hybrid cultivar Salvador are included in its parentage. Enchantment is a teinturier red-wine grape that has shown consistently good production in Arkansas and similar regions. Preliminary work on winemaking potential demonstrated that Enchantment wine has an intense red color and *vinifera* like sensory characteristics. The objective of this research was to identify and quantify anthocyanins in Enchantment grapes and during wine production. Grapes were harvested in 2017 and fermented on the skins for four days, and berry samples were taken prior to crush and wine samples were taken at 8, 16, 24, and 32 days of fermentation. Berry tissues were separated into skins, seeds, and flesh. Skins had the highest total anthocyanins (1165.3 mg/100 g fresh weight), followed by flesh (10.5 mg/100 g), while seeds contained no anthocyanins. Only anthocyanin-3- glucosides, and their acetyl and coumaric acid derivatives, were present in the berry tissues and wine. This was significant, as the native red wine cultivars that grow well in Arkansas typically contain mostly anthocyanin-3,5-diglucosides, which exhibit less color stability. The predominant anthocyanin in berry skins, flesh and wines was malvidin-3-glucoside, and other anthocyanin-3-glucosides included delphinidin, cyanidin, petunidin, and peonidin. Total and individual anthocyanin concentrations increased between 8 (100.4 mg/100 mL total anthocyanins) and 16 days (138.2 mg/100 mL total anthocyanins) of fermentation, and then decreased, likely due to tannin complexation. This study demonstrated that Enchantment grapes and wine have *vinifera*-like anthocyanin profiles, with malvidin-3-glucoside as the predominant anthocyanin. Therefore, wine produced from Enchantment grapes will likely have more depth and stability of color than red wines produced from other hybrid cultivars grown in Arkansas and the surrounding region.

Survey of Grapevine Viruses in Missouri Vineyards

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Almost two decades have passed since GLRaV3, GFV, GVA, ToRSV, and ArMV were reported to be present in Missouri grapevines. These initial virus surveys focused on 5 to 6 vineyards and 4 to 6 viruses. Since then many other grapevine viruses have been reported throughout the world. Recent anecdotal reports of stalled sugar accumulation in some Missouri vineyards in the absence of symptomology suggest that other viral diseases may be present. The objectives were to survey vineyards throughout Missouri for 26 different grapevine viruses, grapevine phytoplasma and *Xylella fastidiosa*. A total of 400 samples were collected with a sample consisting of 16 petioles (4 petioles from 4 different vines). A total of 25 grape cultivars were sampled. Vineyard blocks were randomly sampled in a "W" pattern. After nucleic acids were extracted from petiole samples, nucleic acid samples were analyzed using reverse transcriptase-polymerase chain reaction to detect viral RNA/DNA. Approximately 90% of samples had at least one virus and 65% of samples had two or more viruses. Viruses found were GSPaV (59%), GLRaV3 (53%), GRBV (35%), GVE (31%), GLRaV2 (19%), GVB (17%), GFV (13.5%), GLRaV2RG (9%), GVCV (8%), GVA (0.5%), GLRaV5 (0.2%), and Grapevine phytoplasma (0.2%). Visual inspection of vineyards at time of sampling (July), mid-September, and mid-October only identified GVCV and GRBV. The GRBV symptoms were confined to a single cultivar – Crimson Cabernet in mid-October. Samples from five of six Norton vineyards were 70-100% positive for GRBV. A Norton vineyard established pre-Civil War had no samples positive for GRBV.

Recombinant Identification in a Hybrid Cold-Hardy Grapevine Population for Fine Mapping: A Major Resistance QTL to Foliar Phylloxera

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Previously, a F1 population (N=123), resulting from two advanced University of Minnesota breeding lines MN1264 (resistant) and MN1246 (susceptible), was evaluated in greenhouse and in field conditions for foliar phylloxera infestation. A major QTL was identified on chromosome 14, spanning 12 to 27 cM on the combined parental map. This relatively large region limits the application of marker-assisted breeding and/or identifying candidate genes. An increase of 1000 seedlings of this F1 population was generated in 2017 and is being genotyped in spring 2018 with AmpSeq markers. Primers were designed based on microsatellite sequences, GBS SNP tags, and conserved genes across 5 out of 8 *Vitis* species (*V. aestivalis*, *V. cinerea*, *V. vinifera*, *V. rupestris*, *V. amurensis*, *V. labrusca*, *V. riparia*, *V. vulpina*) in an effort to fine map the QTL. We propose to use AmpSeq to identify recombinants based on genotype data and selectively phenotype recombinants in replicate, in order to reduce the phenotyping cost by focusing on a subset of the 1000 seedlings. This can be used as a standardized process for breeding of other traits in cold-hardy hybrid grape materials.

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