

Project/Activity Number: NE-1720

Project/Activity Title: Multi-state Coordinated Evaluation of Winegrape Cultivars and Clones

Period Covered: November 8, 2020 to November 8, 2021

Date of This Report: January 7, 2022

Annual Meeting Date(s): November 8, 2021 (virtual)

Participants in attendance:

Last Name	First Name	University	email
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Participants not in attendance:

Last Name	First Name	University	email
Bates	Terence	Cornell University	trb7@cornell.edu
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Participants not in attendance (continued):

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Brief Summary of Minutes of Annual Meeting

The Annual Technical Committee meeting was co-hosted by Dean Volenberg of the University of Missouri Grape and Wine Institute, Columbia, Missouri and Mathew Clark of the University of Minnesota on 8 November 2021. The meeting was conducted virtually. Meeting was called to order and the meeting agenda presented. This was followed by brief introductions of attendees. The morning session consisted of state reports and Margaret Smith provided guidelines and deadlines for the grant proposal reapplication process. The afternoon session was devoted to clarifying objectives for the reapplication of the grant proposal entitled “Multi-state Coordinated Evaluation of Winegrape Cultivars and Clones”.

Data Collection Committee

Tim Martinson provided an update on the data collection committee. One of Tim’s goals was to establish a website that would include pertinent data generated from NE-1020 and NE-1720. Although, Tim is retiring in early January 2022, he still has gone out of his way to help the NE-1720 group find an alternative to complete his goal. Shortly after the Annual NE-1720 meeting, Tim contacted Matt Fidelibus at UC Davis about the potential of a collaborative database. Currently, Matt and some of his colleagues have developed a website that consists of cultivars of wine, table, raisin, and rootstocks focusing on *Vitis vinifera* with the goal of adding approximately 20 descriptions per year. This extension undertaking is being funded by NGRA under the NGRA extension chair Keith Striegler. Matt is interested in a collaborative website that includes the NE-1720 data with the caveat if the NGRA is interested.

If the collaborative website moves forward or the NE-1720 group establishes their own website, the Data Collection Committee needs to determine the outputs.

Once again, the main question that needs to be addressed is what information on the cultivars evaluated in the NE-1020 and NE-1720 would be helpful to current and future grape growers.

Germplasm and Discovery Committee

In 2021, Missouri and Kansas established two selections of “loose clustered” Vignoles cultivars as well as the standard Vignole as a comparison. Tim Martinson presented information on the availability of irradiated Vignole germplasm at the annual meeting in 2018. Briefly, a number of Vignole mutants were evaluated based on loose cluster architecture. Mutants were developed by Amanda Garris of the USDA. Approximately 1000 mutants were evaluated of which nine were selected for replicated trials. From these trials, Tim suggested that two mutants be evaluated in replicated trials in interested NE-1720 states. The propagated material was made available through Double A Vineyards in 2021. This is in congruence with the Objective 3 milestone: Propagate and receive cuttings for plantings at collaborator sites.

Joe Fiola suggested other grape materials for evaluation.

Matt Clark provided an update on potential breeding lines for evaluation. The advanced selection MN-1220 will likely be released soon. MN-1220 is a white wine grape for more southern climates compared to Minnesota. The Minnesota grape breeding program is also developing seedless table grape lines that may have a dual purpose for both fresh consumption and the wine industry.

Tim Martinson on behalf of Bruce Reisch also provided an update on selections from Cornell and are included in Tim Martinson’s state report for New York. Briefly,

- NY03.0207.02 – White wine grape
- NY03.0207.06 – White wine selection
- NY03.0208.09 – White wine grape
- NY04.0303.02 – White wine grape
- NY06.0514.06 – This is a highly disease resistant red wine selection

Missouri planted four of the NY selections in 2021. These selections are being made available by Amberg Grapevines.

NY03.0207.02 – This white wine grape has scored very well in wine tastings, with panelists mentioning bright acidity with notes of citrus, melon, apricot and peach. The vine has an excellent large canopy, some leaf phylloxera, and will need protection from bird depredation. The prediction for 50% bud kill is -15.7°F.

NY03.0207.06 – This white wine selection produces a good canopy with moderate resistance to foliar powdery and downy mildews. Fruit are mostly rot-resistance but some sour rot has been noted in some years. Wines have been highly ranked by tasting panels, with aromas described as melon, pear, spicy and pineapple, while the palate descriptors included good structure and body; and mentions of citrus, pineapple apple and Riesling-like characters. The predicted temperature for 50% bud kill is -16.9°F.

NY03.0208.09 – This white wine grape has been described as having citrus, tropical fruit, peach and pear characteristics in both the aroma and palate. It has been very well-liked by tasting panels. Vines have been moderately productive with good resistance to powdery mildew. Bird damage has been a problem and protection (netting) is needed. Some years, rachis necrosis was noted just prior to harvest. The predicted temperature for 50% bud kill is -15.4°F

NY04.0303.02 – This is a white wine grape, which produced the top-ranked white wine from vintages 2013 and 2016. Wine descriptors included muscat, peach, spicy, tropical fruit, mango, grapefruit, dried apricot, lychee, and passion fruit. The 2016 wine had Sauvignon blanc-like tropical fruit and green notes. These vines are productive and vigorous so far, with good resistance to downy and powdery mildews under a hybrid-type spray program. The predicted temperature for 50% bud kill is -15.5 °F.

NY06.0514.06 – This is a highly disease resistant red wine selection. This selection carries the Run1 / Rpv1 genes, as well as Ren2 (for powdery mildew resistance) from *V. cinerea*. Also has excellent resistance to bunch rot, and moderate resistance to black rot. The buds are moderately winter hardy, with expected temperature of 50% bud kill in mid-winter measured to be -16.4°F. Vines are on the small side and grafting on phylloxera-resistant stocks should be tested. Fruit yields are low, due to the use of many clusters for crossing each year. Wine descriptors are as follows: fruity with notes of blackberry, plum, cherry; slightly herbaceous, with green pepper noted; good body and medium tannin; also, some have detected chocolate notes.

Afternoon Session: Hosted by Matt Clark

The afternoon session focused on defining the objectives for the grant proposal reapplication.

Attendees were randomly assigned to break-out rooms. Each break-out room discussed and clarified one of the objectives for the grant proposal reapplication. After a period of time all the break-out room attendees re-joined in the main meeting to present their objectives. A lot of time was spent discussing what data needs to be collected for screening advanced breeder selections and what data needs to be collected for a replicated trial evaluation.

One of the limitations of screening advanced breeder selections is often there is limited cuttings, rooted cuttings or grafted material. Therefore, it was decided that advanced breeder selections would be screened at four different sites (states) that would fully encompass the climatic zones of participating states. Advanced selections that meet the merits of the screening process then could be propagated or cuttings distributed to other states for a full evaluation.

Attendees that volunteered to help Matt Clark with the grant proposal reapplication process were: Horst Casperi, Dean Volenberg, Anne Fennel and Tim Martinson.

Future Annual Meeting locations will be 2022 Kansas hosted by Scott Kohl and 2023 Michigan hosted by Esmaeil Nasrollahiazan.

Accomplishments

Short-term Outcomes: To enhance future facilitation of reporting I have taken the liberty of including the following information of subcommittees formed in 2017: Viticultural practices subcommittee chair, Joe Fiola; Data Collection subcommittee chair, Dan Ward; Outputs and Milestones chair, Tim Martinson; and Germplasm and Discovery chair, Matt Clark.

Outputs: State reports are included as appendix

Activities:

Since the Annual Meeting was virtual there are no activities to report.

Milestones: A brief of what states have reported.

- CO – Identified several cultivars with superior fall bud cold-hardiness
- IA – Cultivar evaluations of MN- and Tom Plocher – cultivars
- KS - Two-selections from North Dakota State University Grape Germplasm Enhancement Project established, ND054.27 and ND213 in 2020
- ND – Continue to evaluate cultivars/selections with acceptable yield potential
- NE – The grape cultivar Itasca identified as a suitable cultivar for grape production
- NJ - Grapevine Pinot Gris Virus (GPGV) was discovered in vines used in the NE1720. Although vines had been imported through Foundation Plant Services new viruses are always being discovered.
- NY – Trialed eight loose-clustered Vignole clones compared to standard Vignole selection. Two advanced selections available to NE-1720 participants
- MA – Ten organic pesticides evaluated for efficacy
- MI – Cold hardiness evaluated of different grape cultivars using differential thermal analysis
- MN – Identified table grape breeding lines
- MO – A new cultivar/advanced breeder selections evaluation trial established in April 2021
- SD – A new 1.75 acre cultivar evaluation trial established
- VT – Grape cultivars from the breeding program of Tom Plocher being evaluated

Seven states have established new plantings of grape cultivars, selections or clones. This is in congruence with Milestone objective 1 (2018).

Impacts

Activities: Nothing to report at this time

Milestones: Nothing to report at this time

Indicators: Nothing to report at this time

Publications:

Aipperspach, A., J. Hammond, and H. Hatterman-Valenti. 2020. Utilizing pruning and leaf removal to optimize ripening of *Vitis riparia*-based 'Frontenac Gris' and 'Marquette' wine grapes in the northern Great Plains. *Horticulturae* 6, 18; doi:10.3390/horticulturae6010018.

Bradshaw, T. (lead author). 2021. Grapes and Wine. Vermont Sustainable Jobs Fund Farm to Plate 2.0 Product Brief. Issue briefs drafted by statute for presentation to Vermont legislature in 2019-2020 session.

Bradshaw, T. UVM Fruit Website (<http://www.uvm.edu/~fruit>). Outreach website for tree fruit and viticulture-related horticultural and IPM information for commercial growers. Affiliated blog archives 12 email postings made to grape producer listserv (275 subscribers) during reporting period.

Gabriel Perez-Gonzalez, Dana Sebestyen, Elsa Petit, Jody Jellison, Laura Mugnai, Eric Gelhaye, Norman Lee, Sibylle Farine, Christophe Bertsch, Barry Goodell. 2021. The Role of Low Molecular Weight Fungal Metabolites in Grapevine Trunk Disease Pathogenesis: *Eutypa Dieback* and *Esca*. Preprint

Hazelrigg, A., T. Bradshaw and G. Maia. 2021. Disease Susceptibility of Interspecific Cold-Hardy Grape Cultivars in Northeastern U.S.A. *Horticulturae* 7(8): 216. Special issue on Grape Responses to Abiotic and Biotic Stresses.

Moreira, L. and M. Clark (2021) Embryo rescue of cold-hardy table grapes. *HortScience* 56(9): 1059-1065.

Olson, J., and M. Clark. 2021. Characterization of Anatomical and Physiological Effects of Variegation Mutation on Grapevine. *HortScience* 56(10): 1251-1257.

Sabbatini, P. and E. Nasrollahiazan. 2021. Freezing stress, cold hardiness and managing winter damaged vines. MSU Extension Website.

Schoelz, J., D. Volenberg, M. Adhab, V. Klassen, C. Spinka, and M. Al Rwahnih. 2021. A Survey of Viruses Found in Grapevine Cultivars Grown in Missouri. *Am J Enol Vitic* 72:73-84.

Svyantek, A., B. Kose, J. Stenger, C. Auwarter, and H. Hatterman-Valenti. 2020. Cold-hardy grape cultivar winter injury and trunk re-establishment following severe weather events in North Dakota. *Horticulturae* 6(4): 1–15.

- Ware, L., Garofalo, E., Petit, E., and Piñero, J.C. 2021. Does the Red Color Enhance Spotted Wing *Drosophila* Response to Traps Baited with Diluted Concord Grape Juice? *Fruit Notes* 86: 15-16.
- WatreLOT, A. 2021. Tannin content in *Vitis* species red wines quantified using three analytical methods. *Molecules*. 26(16):4923 (11pp)
- Yilmaz T., D. Alahakoon, and A. Fennell. 2021. Freezing tolerance and chilling fulfillment differences in cold climate grape cultivars. *Horticulturae* 7(1):4
- Yilmaz T., And A. Fennell. 2021. Spur and short cane pruning influence bud viability, yield, and fruit quality. *Proceedings of the South Dakota Academy of Science* 100:95-105.
- Yin, L., A. Karn, L. Cadle-Davidson, C. Zou, A. Underhill, P. Atkins, E. Treiber, D. Voytas, and M. Clark. 2021. Fine mapping of leaf trichome density revealed a 747-kb region on chromosome 1 in cold-hardy hybrid wine grape populations. *Frontiers in plant science* 12: 150.
- Yin, L., E. Burkness, W. Hutchison, and M. Clark. 2021. Effects of Foliar Phylloxera (Hemiptera: Phylloxeridae) Infestations on Wine Grape Photosynthesis, Yield, and Fruit Quality. *Journal of Entomological Science* 56(4): 504-518.

Scientific and Outreach Oral Presentations (*relative to NE 1720 activities*):

- Caspari, H. 2/22/2021: Retraining vines after cold injury. Webinar.
- Clark, M. 2021. Panelist: Future Grape Cultivars for Eastern North America. ASEV-ES Virtual Conference.
- Clark, N. and S. Kohl. 7/24/2021. Home Winemaking Workshop. Riley County Fair. Manhattan, KS. 8 Attendees.
- Fennell, A. 2021. Cold climate cultivars for upper Midwest. Fermentation, Brewing and Spirits class.
- Fennell, A. 6/26/2021. Field tour of grape genetics. Brookings Area Master Gardeners Tours.
- Fennell, A. 9/13/2021. Cold climate cultivars fruit characteristics. Local Foods Education Center, Brookings SD.
- Fitch-Deitz, C. and S. Kohl. 11/9/2021. NE1720 Annual Conference host. 25 Attendees.
- Fitch-Deitz, C. 2/8/2021. Pruning Workshop. Dover, KS. 13 Attendees.

Fitch-Deitz, C, N. Clark, and S. Kohl. 7/27/2021. Viticulture and Enology Field Day. Wamego, KS. 28 Attendees.

Kadium, V., A. Svyantek, J. Stenger, S. Bogenrief, C. Auwarter, and H. Hatterman-Valenti. 2020. Diallel populations representing NDSU-GGEP. Proc. North Dakota Acad. Sci. 74:44.

Kohl, S. 4/26/2021. Grapes and Wine in Kansas. Kansas Academy of Nutrition and Dietetics. Wamego, KS. 48 Attendees.

Kohl, S. Winemaking in Kansas. 6/10/2021. Lawrence Brewing Guild Quarterly Meeting. Lawrence, KS. 34 Attendees.

Kohl, S. 7/30/2021. Building an On-Ground V&E Program from Scratch. Zoom with Pellissippi State Community College and Tennessee industry representatives. 5 Attendees.

Kohl, S. 9/3/2021. Emcee, Kansas Grape Stomp. Kansas State Fair. Hutchinson, KS. 80 Attendees.

Martinson, T. July 25, 2013. Testing Loose-clustered Vignoles clones. (Presenter Only) Lake Erie Regional Grape Program Summer Conference, Cornell University and Penn State University, Portland, NY.

Moreira, L., Z. Vickers, E. Treiber, A. Andresen, M. Clark, and A. Hegeman. 8/7/2021. A procedure to investigated flavor in large grape samples. ASHS Conference. Denver, CO.

Nasrollahiazar, E. 3/23/2021. Michigan Statewide Grape Spring Kickoff. Webinar.

Nonnecke, G. 8/11/2021. Field day and Workshop – Topics: grape production and berry analysis used for harvest determination of cold-climate cultivars. Iowa State University, Horticulture Station, Ames, IA. 25 Attendees.

Nonnecke, G. 8/3/2021. Field day and Workshop – USDA, Iowa Farm Service Agency Loss Adjuster Training. Topics: grapevine biology, production, and management of Iowa vineyards. Iowa State University, Horticulture Station, Ames, IA. 12 Attendees.

Petit, E. 1/13/2021 - Over zoom - Massachusetts Fruit Growers Association Annual Meeting 2021: "Through the grapevine in Massachusetts in 2020: updates and new research" - about 100 attendees

Petit, E. 4/13/2021 - Over zoom - Fruit Twilight Meeting – “April updates on viticulture in MA” – about 100 attendees

Petit, E. 5/6/2021 - Over zoom - Fruit Twilight Meeting - “May updates on viticulture in MA” – about 100 attendees

Petit, E. 7/14/2021 - In person at Clarkdale Fruit Farms - Massachusetts Fruit Growers Association – “Midyear updates on field trials on grapes” – about 100 attendees

Petit, E. 7/22/2021- In person at Cold Spring Orchard - Summer Scholars Field Trip - “Trial on disease resistance in the NE1720 plot” – about 50 attendees

Petit, E. 1/30/2021 - Over zoom - MassAggie pruning workshop 2021 – about 90 attendees

Read, P. 1/25/2021. New UNVP Research Results. Nebraska Winery and Grape Growers Association Annual Conference.

Read, P. 3/15/2021. University of Nebraska Viticulture Program Progress Report. Nebraska Grape and Wine Board (Nebraska Department of Agriculture).

Read, P. 5/14-15/2021. The University of Nebraska Viticulture Program. NWGGA’s “Toast Nebraska” public wine showcase event.

Read, P. 7/19/2021. Viticulture Field Day. Topics: trellising, insect management and vineyard floor management for newly adopted cultivars.

Read, P. 9/29/2021. Nebraska: the Next Napa Valley?. Northeast Lincoln Kiwanis Club.

Read, P. 10/29/2021. Wines 101. University of Nebraska Alumni Women’s Leadership Group. 60 Attendees.

Read, P. 11/5/2021. Nebraska’s Burgeoning Grape and Wine Industry. University of Nebraska LEAD 39 Class of young developing agricultural leaders.

Svyantek, A. and H. Hatterman-Valenti. 7/29/2020. Observations on inheritance of lacinate leaves in hybrid grapevine populations derived from ‘Chasselas Cioutat’. American Society of Enology and Viticulture and American Society of Enology and Viticulture Eastern Section Virtual Conference.

Volenberg, D. 2021. Grape IPM Reports. <https://gwi.missouri.edu/IPMreports/index.htm>

Ward, D. 2021. Grape growers and educators in the viticulture industry attended a symposium where they learned of the Grapevine Pinot Gris Virus (GPGV). Over 100 attendees.

Wise, A. 2020. [Performance of Selections in the Long Island Wine Grape Variety Trial](#). Presentation slides online.

Authorization:

The NE-1720 Annual Meeting conducted on November 8, 2021 was authorized on 22 September 2021 through the office of Margaret Smith.

Appendix:

State Reports

NE1720: MULTI-STATE EVALUATION OF WINEGRAPE CULTIVARS AND CLONES

State: Colorado

Author(s): Horst Caspari

Timing of Activities: October 2020 to November 2021

- 1. Impact Nugget:** Identified several *Vitis vinifera* cultivars with superior fall bud cold hardiness. Those cultivars had high bud survival and produced full crops after two record-breaking cold events (Oct 2019, Oct 2020) while most other *Vitis vinifera* cultivars had low (2020) or no yields (2021).
- 2. New Facilities and Equipment:** n/a

- 3. Unique Project-Related Findings:** A record-breaking cold event on 26 October 2020 caused 100 % or near 100 % primary bud kill on most *Vitis vinifera* cultivars. Only four out of 23 *V. vinifera* cultivars included at the Hot-Cold site had more than 50 % primary bud survival (Albarino, Cabernet Dorsa, Tocai Friulano, Zweigelt). Inter-specific cultivars Chambourcin and Marquette had 81 % and 100 % primary bud survival, respectively. Six cultivars were removed due to low yields and high vine mortalities (Garnacha tinta, Graciano, Refosco, Tinta Carvalha, Tocai Friulano, Verdejo). Five new cultivars were added in spring 2021 (Agria, Arinto, Corvina Veronese, Sagrantino, Teroldego). There was no yield in 2021 on Cabernet Sauvignon, Cinsault, Durif, Malvasia bianca, Merlot, Mourvedre, and Touriga Nacional, and many vines needed retraining from the ground. Yields were less than 1 ton/acre for Barbera and Souzao, and 1.15 ton/acre for Roussanne. Yields of Albarino, Cabernet Dorsa, Chambourcin, Marquette, Verdelho, and Zweigelt were near or above the long-term average and ranged from 3.3 to 4.1 ton/acre. At the Hot-Cold site temperatures dropped to 0 F on 27 October 2020. Primary bud damage was at or near 100 % on all cultivars except for Aromella (38 %), MN 1200 (17 %), and Marquette (8 %).

This was the second record-breaking cold event in late October with very similar ranking of cultivars with regard to bud cold damage. The data indicate that Cabernet Dorsa and Zweigelt acclimate early and have better bud cold hardiness in early fall than all other *Vitis vinifera* cultivars included in our trial. These results are indeed confirmed by data from regular controlled freezing tests conducted over the past 4 years. Both cultivars also have very good maximum bud cold hardiness (minimum LT₅₀ of -20 F). Of particular interest is that both cultivars share one parent (Lemberger). An industry-wide survey of bud cold damage following the October 2020 cold event found that Lemberger was one of the *Vitis vinifera* cultivars with the least damage. This suggests that the early cold acclimation of Cabernet Dorsa and Zweigelt might be inherited from Lemberger, and that other cultivars derived from crosses with Lemberger might also have advanced bud hardiness in fall. Cold damage during the acclimation

period is the number one reason for low yields in Colorado and finding additional cultivars with advanced hardiness could be of great economic value.

4. Accomplishments Related to each of the 3 Objectives:

5. Impact Statements:

There has been a substantial change in the cultivar mix in Colorado's vineyards over the past 6-10 years. This change is the result of extreme cold events in December 2009, January 2013, and December 2013 causing large yield reductions in 2010, 2013, and 2014. Cold-tender *Vitis vinifera* cultivars were removed from about 20 % of Colorado's vineyard area and replaced with more cold-hardy inter-specific cultivars. Approximately 50 % of that area was planted with cultivars tested in the NE-1020 / NE-1720 sites in Colorado. That percentage increases to nearly 80 % when cultivars evaluated by NE-1020 / NE-1720 collaborators are included.

The record-breaking cold event on 26 October 2020 resulted in nearly 100 % bud kill on cold-tender *Vitis vinifera* cultivars which account for about 80 % of Colorado's vineyard area. As a consequence, the 2021 grape production is predicted to drop by about 80 %. Almost all of the 2021 crop will come from cold-hardy, interspecific cultivars planted during the past 6-10 years.

6. Published Written Works (relative to NE-1720 activities) n/a

7. Scientific and Outreach Oral Presentations (relative to NE 1720 activities)

Caspari, H.: Retraining vines after cold injury. Webinar, 22 Feb 2021 (30).

[https://us02web.zoom.us/rec/play/ozyGibLIG2cocM1T_5-](https://us02web.zoom.us/rec/play/ozyGibLIG2cocM1T_5-soBlmGVI1ea5uByFjMZIH4sXmLNq_ZJA9yy0HXWII204h11Szj6zSC1O0bNiv.mYcgLSDmgs9IFUGY?continueMode=true)

[soBlmGVI1ea5uByFjMZIH4sXmLNq_ZJA9yy0HXWII204h11Szj6zSC1O0bNiv.mYcgLSDmgs9IFUGY?continueMode=true](https://us02web.zoom.us/rec/play/ozyGibLIG2cocM1T_5-soBlmGVI1ea5uByFjMZIH4sXmLNq_ZJA9yy0HXWII204h11Szj6zSC1O0bNiv.mYcgLSDmgs9IFUGY?continueMode=true)

8. Fund Leveraging (relative to NE 1720 activities) n/a

**NE1720: MULTI-STATE EVALUATION OF WINEGRAPE CULTIVARS
AND CLONES**

2021 Report

State: Iowa

Author(s): Iowa State University

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Timing of Activities: Nov. 2020-2021

Impact Nugget:

New Facilities and Equipment:

Announcements:

Faculty and Personnel:

New faculty member in horticulture.

[Dr. Suzanne Slack](#) was hired as Assistant Professor in the Department of Horticulture, with state-wide extension responsibilities in fruit crops. Suzanne started her position November 1, 2021.

Dr. Lester Wilson retired as University Professor Emeritus in the Department of Food Science and Human Nutrition.

Unique Project-Related Findings:

In Iowa:

Accomplishments related to each of the 3 Objectives:

1. Screen the viticulture characteristics of clones, cultivars, and elite germplasm with significant potential throughout the USA.

Grape cultivars, Marquette, La Crescent, Crimson Pearl, Petite Pearl, and Itasca, produced acceptable fruit yield in 2021. The 2021 growing season had its lowest average daily temperature of 0.1°C at GDD 0 (April 1st), and the highest ADT of 28.9°C at GDD 1965.7 (July 28th) ([Iowa Environmental Mesonet](#)). The berry ripening season from July to September was exceedingly dry, with cumulative rainfall precipitation of 20 cm in 2021 compared to about 35 cm in 2020, which also was lower than normal. Various wasps, including yellowjackets, attacked 'Crimson Pearl' and 'Petite Pearl' prior to full maturity.

2. Evaluate the viticultural and wine attributes of promising emerging cultivars and genotypes based on regional needs.

Leaf removal was applied in 2020 and 2021 on 'Marquette' grapevines trained to a single-curtain, high-cordon training system. Between 6 and 8 leaves were removed at the top of shoots downward to a length of where clusters were present and on the east side of the canopy's shoots. Photosynthetically active radiation (PAR) was measured at the top of the shoots monthly. Grape yield and chemistry were evaluated.

Leaf removal did not impact yield of 'Marquette' in 2021. 'Marquette' grape chemistry was significantly impacted by leaf removal at veraison with a higher degree Brix and lower total acidity in fruit from grapevines with leaves removed. But, no significant differences were observed at harvest. Tannin content was not detectable in 'Marquette' grapes at harvest and tannin content decreased from post fruit-set to veraison.

'Crimson Pearl' at harvest maturity showed a degree Brix of 21.3, pH of 3.32 and TA of 5.1 g/L while 'Petite Pearl' was harvested before maturity, due to wasps, at a degree Brix of 16.8, pH 3.12 and TA of 7.3 g/L. In terms of phenolic compounds, especially

tannins, responsible for red wine astringency perception, Petite Pearl may be a promising cultivar compared to Frontenac and Marquette.

3. Conduct explorations of new germplasm and lesser-known cultivars that may have economic potential for the US wine industry.

Impact Statements

Published Written Works (relative to NE-1720 activities)

Watrelet A. A. 2021. Tannin content in *Vitis* species red wines quantified using three analytical methods. *Molecules*. 26(16):4923 (11pp) <https://doi.org/10.3390/molecules26164923>

Scientific and Outreach Oral Presentations (relative to NE 1020 activities)

Field day and workshop – Topics: grape production and berry analysis used for harvest determination of cold-climate cultivars. Iowa State University, Horticulture Station, Ames, IA. 11 August 2021; 25 participants of Iowa, Nebraska, and Minnesota.

Training workshop – USDA, Iowa Farm Service Agency Loss Adjuster Training. Field portion topic: grapevine biology, production, and management of Iowa vineyards. Iowa State University, Horticulture Station, Ames, IA. 3 August 2021; 12 participants.

Fund Leveraging (relative to NE 1020 activities)

NE1720: MULTI-STATE EVALUATION OF WINEGRAPE CULTIVARS AND CLONES

2021 Report

State: Kansas

Author(s): Scott Kohl, Candice Fitch-Deitz

Timing of Activities: 10/1/2020 – 9/30/2021

1. Impact Nugget

Kansas vineyards and wineries continually inquire about growth and winemaking data resulting from the 2013 Trial Plot as they expand their commercial plantings. Frontenac Gris, Brianna, Petite Pearl, Chambourcin, and Vignoles are the most popular among recent commercial plantings. Throughout the past year, Kansas industry representatives have expressed a desire to submit application(s) for AVA development. Recently, Highland has been approached to help lead the effort, beginning with grant writing and plans to cooperate with Kansas Departments of Agriculture and Commerce to create AVA(s). Ultimately, trust in Highland Community College Viticulture and Enology Program's efforts and abilities are growing throughout the grape and wine industry in Kansas.

2. New Facilities and Equipment

Highland was fortunate to be approached to affordably purchase several items of discounted (used) winery equipment. Two wine presses are included in the mix. One large and one small which was utilized in pressing the small batches of juice and/or wine from the HCC 2013 trial plot. A second Conex container was also obtained to store this equipment during the off season.

Other equipment purchased includes a "medium" sized crusher/destemmer/must-pump, eight macro-bins for harvest, and a macro-bin trailer. As HCC's commercial-scale vineyards mature to full production these items will be vital in getting crop from the field to winery.

Finally and most importantly, Highland Community College was fortunate to hire a new Enology instructor, winemaker, and incubator mentor. Ms. Nicole Clark started her duties April 26th.

3. Unique Project-Related Findings

Three consecutive nights of post bud-break freeze, April 15-17, caused significant losses to Marquette. Estimated that greater than 75% of the crop was lost to freeze. Herbicide drift throughout the growing season has become the leading issue in Kansas grape production with focus on canopy development and yield losses.

4. Accomplishments Related to Each of the 3 Objectives

1. Screen the viticulture characteristics of clones, cultivars and elite germplasm with significant potential throughout the USA.
 - a. Evaluation plot established in 2013, separate from NE1020 and NE1720. Annual wine evaluations started in 2017. Forty-four cultivars, 12 vines each. Updated growth and harvest data published online¹.
 - b. Second evaluation plot established in 2018. First crop expected in 2022. Crimson Cabernet and Zinthiana.
 - c. Third trial and evaluation site, established in 2020. Two trial varieties from North Dakota State University Grape Germplasm Enhancement Project established, ND054.27 and ND213 planted in 2020. Expansion in May 2021 included three trial varieties from Cornell University; R65v83, R67v79, and Vignoles. Evaluation rows include Frontenac Blanc, Frontenac Gris, Itasca, Mars (seedless), Lakemont (seedless), and Vanessa (seedless). Plantings in 2023 to include Verona and additional trial varieties from NE1720 partner institutions. The plot has space for 7 additional germplasm trials and up to 4 more evaluation varieties.
2. Evaluate the viticultural and wine attributes of promising emerging cultivars and genotypes based on regional needs.
 - a. Juice and must data from 2013 Evaluation Plot listed above².
 - b. One of the viticultural attributes that Kansas grape growers are looking for in varieties is the ability of the vines to produce sufficient canopy and crop yield while being impacted by herbicide drift.
 - i. Canopy management is a labor intense process which has been further complicated by herbicide drift throughout the growing season. Visual signs of herbicide drift have been seen on grape varieties from early season to after harvest. The most common impact to canopy development is the senescence of the shoot growing tip followed by lateral shoot growth.
 1. This cycle repeated multiple times during the 2021 growing season resulted in; stunted growth of vines planted in May 2021, lateral branching on lateral shoots, and loss of an upward growth habit. Observations and data will continue to be collected on the impact that herbicide drift has on vine development during the establishment years of vines.
 2. On established vines, canopies become dense due to lateral shoot development. Additional combing and shoot removal during the growing season becomes necessary to allow adequate air and light penetration into the canopy.
 - ii. Of the varieties in the 2013 Evaluation Plot, the following varieties were the most severely impacted by herbicide drift: Aromella, Arandell, Vidal blanc, Vignoles, Vidal blanc. Largest impact on yield was seen when vines were drifted during flowering. Severity ranged from decreased berry set within clusters to complete senescence of the flowers resulting in complete crop loss. Shoot development was the most stunted in

Arandell. Shoots were short and compact, with many lateral branches which also remained stunted. The vines had an appearance of a topiary without being physically trimmed by hand.

3. Conduct explorations of new germplasm and lesser-known cultivars that may have economic potential for the US wine industry.
 - a. N/A

5. Impact Statements

Highland Community College's ongoing efforts to operate the 456 Wineries business incubator has seen three new wineries emerge in different ways. One client is moving out to open their winery outside the incubator, one moved in and released wines in Oct 2021, and a third has committed to moving in during the spring 2022. The incubator continues to accelerate industry growth.

6. Published Written Works (Relative to NE1720 Activities)

N/A

7. Scientific and Outreach Oral Presentations (Relative to NE1720 Activities)

- Fitch-Deitz, C. Kohl, S. NE1720 Annual Conference host. 11/9/2021. 25 Attendees.
- Fitch-Deitz, C. Pruning Workshop. Dover, KS. 2/8/2021. 13 Attendees.
- Kohl, S. Grapes and Wine in Kansas. Kansas Academy of Nutrition and Dietetics. Wamego, KS. 4/26/2021. 48 Attendees.
- Kohl, S. Winemaking in Kansas. Lawrence Brewing Guild Quarterly Meeting. Lawrence, KS. 6/10/2021. 34 Attendees.
- Fitch-Deitz, C; Clark, N; Kohl, S. Viticulture and Enology Field Day. Wamego, KS. 7/27/2021. 28 Attendees.
- Kohl, S. Building an On-Ground V&E Program from Scratch. Zoom with Pellissippi State Community College and Tennessee industry representatives. 7/30/2021. 5 Attendees.
- Clark, N; Kohl, S. Home Winemaking Workshop. Riley County Fair. Manhattan, KS. 7/24/2021. 8 Attendees.
- Kohl, S. Emcee, Kansas Grape Stomp. Kansas State Fair. Hutchinson, KS. 9/3/2021. 80 Attendees.

8. Fund Leveraging (Relative to NE1720 Activities)

Viticulture and Enology Science and Technology Alliance (VESTA) 2021-2024 sub-award. NSF-ATE. Norgren, M. Co-PIs: Fitch-Deitz, C; Bower, D; Trebets, E. Aug 2021 – June 2024, \$393,391. National Resource Center and Online Education Emphasis.

9. Online resources

1. https://highlandcc.edu/pages/grapes_0
2. <http://456wineries.com/literature/>

North Dakota NE1720 Summary 2021

Harlene Hatterman-Valenti, Professor
h.hatterman.valenti@ndsu.edu, North Dakota State University

Graduate students: Andrej Svyantek PhD, Sarah Borgenrief MS, Venkateswara Kadium MS, and Jacob Lachowitz MS

1. Screen the viticulture characteristics of clones, cultivars and elite germplasm with significant potential throughout the USA.

North Dakota State University Grape Germplasm Enhancement Project

Efforts towards identification of acceptably yield genotypes include field, greenhouse, and fermentation screenings. For VitisGen2, there is on-going crossing to incorporate powdery mildew resistance allele (RUN1) successfully into NDSU-GGEP germplasm.

2. Evaluate the viticultural and wine attributes of promising emerging cultivars and genotypes based on regional needs.

The Northern Crops Institute has hired Brent Trela to conduct microvinification of fruiting accessions in collaboration of a SCBG. NCI will also direct the sensory evaluation of these samples.

3. Conduct explorations of new germplasm and lesser-known cultivars that may have economic potential for the US wine industry.

Continue to collaborate with VitisGen2 with a goal of isolating useful molecular markers and genomic predictors guiding the selection of early ripening, low-acid grapevine selections. Fruit composition was monitored from samples collected in three consecutive harvests (individuals per harvest, n=581, 553, 507) at ~12 day intervals to form an understanding of ripening dynamics in population with partial rhAmpSeq map; conducted phenotyping of phenological traits (bud break, bloom, shoot development, veraison, wood acclimation) every 3-14 days from early May- mid October; collected and screened genotypes via differential thermal analysis to monitor winter freeze resistance (October-November 2020; February-March 2021). On-going trials are geared towards screening the NDSU grape germplasm collection for temperature adaptive acclimation responses in growth chamber settings. Also finishing SCBG trials comparing different thermal analysis testing to evaluate cold hardiness and a trial to reduce generation timelines through the creation of useful selection indices and development of informative predictive correlations.

A joint trial with the UM (Clark) is evaluating how soils impact cold hardy grapes and wine quality. Lastly, trials were initiated (field and GC) to identify adaptive management responses to extreme climactic swings for North Dakota's Grape and Wine Industry.

List publications arising from your collaborative research projects including journal articles, book chapters, review articles, theses, proceedings, and extension publications. Please use ASHS style (examples pages 14-15 of pdf at http://c.ymcdn.com/sites/www.ashs.org/resource/resmgr/files/style_manual.pdf).

Presentations:

- Kadium, V.R., A. Svyantek, J. Stenger, S. Bogenrief, C. Auwarter, and H. Hatterman-Valenti. 2020. Diallel populations representing NDSU-GGEP. Proc. North Dakota Acad. Sci. 74:44.
- Svyantek, A. and H. Hatterman-Valenti. 2020. Observations on inheritance of lacinate leaves in hybrid grapevine populations derived from 'Chasselas Cioutat'. American Society of Enology and Viticulture and American Society of Enology and Viticulture Eastern Section Virtual Conference, July 29.

Publications:

- Aipperspach, A., J. Hammond, and H. Hatterman-Valenti. 2020. Utilizing pruning and leaf removal to optimize ripening of *Vitis riparia*-based 'Frontenac Gris' and 'Marquette' wine grapes in the northern Great Plains. Horticulturae 6, 18; doi:10.3390/horticulturae6010018.
- Svyantek, A., B. Kose, J. Stenger, C. Auwarter, H. Hatterman-Valenti. 2020. Cold-hardy grape cultivar winter injury and trunk re-establishment following severe weather events in North Dakota. Horticulturae. 6(4): 1–15.

NE1720: MULTI-STATE EVALUATION OF WINEGRAPE CULTIVARS
AND CLONES

State: Nebraska

Author(s): Paul E. Read, University of Nebraska viticulture Program (UNVP)

Timing of Activities: January 2021 to November 2021

1. Impact Nugget: New cultivars continue to be adopted by Nebraska growers and wineries, with Itasca as a prime example. This cultivar has shown very manageable vineyard characteristics, which have translated into production of excellent dry white wines.

2. New Facilities and Equipment: Construction of a high tunnel on a commercial vineyard property for testing *Vitis vinifera* cultivars was completed in 2021 with Cabernet Sauvignon, Petit Verdot, Tannat, Zinfandel and Riesling established in the 2021 growing season; plantings of Swanson experimental hybrids were included for comparison.

3. Unique Project-Related Findings: Table grapes grown in a high tunnel have been highly successful in producing high yields of attractive, damage-free clusters of Thomcord, Somerset Seedless, Mars, Marquis, Canadice and Everest. This success stimulated funding to initiate the vinifera project noted in #2 above.

4. Accomplishments Related to each of the 3 Objectives:

5. For Objectives 2 and 2: See impact statement (#1, above). Nearly 100 cultivars and numbered selections have been tested as part of NE 1720. Wide adoption of successful cultivars has taken place in the Nebraska grape and wine industry, including Frontenac clones, Aromella, Petite Pearl, Marquette, La Crescent, Verona and Itasca.

6. Impact Statement: A significant number of Nebraska grape growers have adopted cultivars tested under the aegis of NE 1720 (many tested initially as numbered selections). (See preceding listings noted in #1 and #5).

7. Published Written Works (*relative to NE-1720 activities*): Read, P. E., S. Gamet and B. Loseke - "High Tunnel Table Grapes: Overcoming Harsh Growing Conditions to Produce Premium Fruit" – HortScience August 8, Denver CO (Abstract)
 - Hybrid Trunk Disease Evaluation: A Serendipitous Opportunity – ASEV, June 24, 2021.

8. Scientific and Outreach Oral Presentations (*relative to NE 1720 activities*):

- January 25, 2021 “New UNVP Research Results” – presented as part of the Nebraska Winery and Grape Growers Association annual conference.
- March 15, 2021 “University of Nebraska Viticulture Program Progress Report” – presented to the Nebraska Grape and Wine Board (Nebraska Department of Agriculture).
- May 14&15 – “The University of Nebraska Viticulture Program” – presented multiple times as part of the NWGGA’s “Toast Nebraska” public wine showcase event.
- July 19, 2021 – “Viticulture Field Day” – focus on trellising, insect management and vineyard floor management for newly adopted cultivars.
- September 29, 2021 – “Nebraska: the Next Napa Valley?” – Northeast Lincoln Kiwanis Club
- October 29 - “Wines 101” Presentation to the University of Nebraska Alumni Womens Leadership Group – 60 in attendance
- November 5, 2021 – “Nebraska’s Burgeoning Grape and Wine Industry” – presented to the University of Nebraska LEAD 39 class of young developing agricultural leaders.

9. Fund Leveraging (*relative to NE 1720 activities*): *

- 2019 – Nebraska Department of Agriculture (NGWB) - Crop Reduction Study - research to evaluate impact of reducing crop yield on wine quality - \$68,000
- 2018 – NGWB - High Tunnel Table Grape Production - \$59,000
- 2020 – NGWB – High Tunnels for *Vitis vinifera* grape Production- \$ 73,000
- 2021 – Nebraska Department of Agriculture – “Develop a Standard Grape Quality Evaluation Program” - \$77, 000

NE1720: MULTI-STATE EVALUATION OF WINEGRAPE CULTIVARS
AND CLONES

State: New Jersey

Author(s): Daniel Ward

Timing of Activities: January 2021 to November 2021

1. Impact Nugget:
 - a. Grapevine Pinot Gris Virus (GPGV) was discovered in vines used in the NE1720. Although vines had been imported through Foundation Plant Services new viruses are always being discovered.

2. New Facilities and Equipment:
 - a. None to report.

3. Unique Project-Related Findings:
 - a. Grapevine Pinot Gris Virus (GPGV) was discovered in vines used in the NE1720. Although vines had been imported through Foundation Plant Services.

4. Accomplishments Related to each of the 3 Objectives:
 - a. Replicated screening trial of 'Grenache noir' Lewis clone, 'Malvasia bianca' clone FPS03, 'Casetta', 'Cabernet Sauvignon' clone FPS34.1, and 'San Marco' was established and now will yield initial phenological data.
 - b. Evaluation of disease-resistant cultivars 'Arandell', 'Marquette', and 'Regent' produced wines which are now being tested by industry members and compared across two training systems.

5. Impact Statements:
 - a. Over 100 growers and educators in the viticulture industry attended a symposium where they learned of the Grapevine Pinot Gris Virus (GPGV).

6. Published Written Works (*relative to NE-1720 activities*)

7. Scientific and Outreach Oral Presentations (*relative to NE 1720 activities*)

Grape Cultivar Development and Four Recently-Imported Italian Varieties. As part of:
American Society for Enology and Viticulture-Eastern Section Annual Virtual Conference

Panel: Future Grape Cultivars for Eastern North American Growers (Panel Participants: Dr. Matthew Clark, University of Minnesota, Dr. Joseph Fiola, University of Maryland Extension, Dr. Oliver Trap, Institute for Grapevine Breeding, and Dr. Daniel Ward, Rutgers Univ).

8. Fund Leveraging (*relative to NE 1720 activities*)

NE1720: MULTI-STATE EVALUATION OF WINEGRAPE CULTIVARS AND CLONES

State: New York

Author(s): Tim Martinson and Bruce Reisch

Timing of Activities: January 2021 to November 2021

1. **Impact Nugget:** Two USDA “Loose Clustered” Vignoles selections that have significantly less fruit rot incidence and severity than the standard Vignoles clone distributed to NE1720 cooperators. Plantings established in 2021 in MO, KS (other places?)

2. **New Facilities and Equipment:**

N/A

Unique Project-Related Findings:

Loose-clustered Vignoles:

- We’ve tested 8 Loose-clustered clones vs the ‘standard Vignoles selection’
- All reduced fruit rots by 30-70% compared to ‘standard’
- Some have consistently produced moderate sized clusters
- We selected 4, tested them for virus.
- Two had LRaV-3, Two (R65V83 and R67V79) tested clean.
- Double A vineyards propagated grafted R65V83 and R67V79 vines in 2020, and made available to NE1720 participants.
- Plantings of the 2 clones + ‘standard’ Vignoles planted in MO and KS (other locations?)
- A larger scale planting is planned at Bully Hill Vineyards in 2022.

Reisch releases:

- Five Geneva Accessions to consider for NE1720. Bruce Reisch has made 4 white and one red selections available through Double A vineyards to NE1720 participants. (see attached)

Alice Wise Variety trials:

- A 1.5 acre winegrape variety trial is located at the Long Island Horticultural Research and Extension Center in Riverhead, NY.
- The goal of the trial is to assess the suitability of a range of varieties to Long Island’s maritime climate and sandy soils.
- 35 *vinifera* and 5 hybrid varieties are grown. The trial has been in place (though varieties have changed) for 28 years.
- 2021 results: After a very dry season in 2020, the 2021 season had more than ample rainfall, making disease management a priority. With excellent fruit set and big berries in white varieties, yields were above average. The very warm

weather, > 3500 GDD, resulted in fruit with modest Brix, 19-21°, low acids and wonderful flavors. As of November 3, the very last blocks of Cabernet Sauvignon were being hand harvested.

3. Accomplishments Related to each of the 3 Objectives:

4. Impact Statements:

Problem: Vignoles is known for high wine quality. But the variety has tight clusters and thin skins, Making it prone to botrytis, sour rot, and berry splitting, causing yield loss and quality issues for fermentation (high volatile acidity)

Hypothesis: If clones could be produced through irradiation that resulted in looser clusters, the propensity for rots to spread within-clusters would decrease.

History:

Amanda Garris USDA-ARS irradiated dormant Vignoles canes and buds

Ca 1000 vines grafted on rootstock and planted around 2009

Peter Cousins evaluated for 3 years

20 'Loose-clustered' clones selected for Propagation

2013 – Planted at Cornell Agritech

2015 – 8 clones and Standard planted at CLEREL

Result: Multi-year evaluations of cluster rot incidence and severity showed that all 8 irradiated vines significantly reduced rot severity by 30-70%, compared to standard Vignoles. Two clones have been propagated and released to NE1720 for multi-site evaluations.

Impact: Vignoles is one of the top varieties grown in MO, with significant plantings in IL, IND, OH, and NY. It is a mainstay of Bully Hill Vineyards in NY. Loose-clustered clones will significantly reduce losses due to cluster rots, and may require fewer fungicide sprays.

5. Published Written Works (*relative to NE-1720 activities*)

Martinson, T. E. 2020. Fruit Composition – Three Vignoles clones harvested from experimental planting at Cornell AgriTech. [2020 Veraison to Harvest #6](#).

Martinson, T. E., J. Van Zoeren, T. Bates, and G.Y. Zhong. 2019. Preliminary results from Loose-clustered Vignoles clonal trial. [2019 Veraison to Harvest #5](#)

Martinson, T. E. 2019. "Loose-Clustered" Vignoles harvested at CLEREL. 2019 [Veraison to Harvest #4](#).

Martinson, T. E., G. Y. Zhong, and L. Cadle-Davidson [Loose Clustered Vignoles Clones reduced Fruit Rots in 2016](#). 2016 Veraison to Harvest #8

Martinson, T. E. and G. Y. Zhong. 2014. Loose-clustered Vignoles clones. 2015 [Veraison to Harvest #4](#)

Martinson, T., Wilcox, W. F., Vanden Heuvel, J. E. (2011). Project Focus: Vignoles, Shoot thinning, and fruit rots. In Martinson, T. E. and C. Gerling (Ed.), Veraison to Harvest: Statewide Vineyard Crop Development Update (5th ed., pp. 3-4). Geneva NY: Cornell University.

Nisbet, M., Mansfield, A. K., Martinson, T., Cheng, L. (2010). Vignoles harvest: Shoot thinning, training system and Botrytis. In Tim Martinson & Chris Gerling (Ed.), Veraison to Harvest (5th ed., pp. 8; <http://www.cals.cornell.edu/cals/grapesandwine/veraison-to-harvest/upload/Veraison-to-Harvest-2010-5.pdf>). Geneva, NY: College of Agriculture and Life Sciences Viticulture and Enology Program.

Wise, A. [Evaluation of Winegrape Cultivars on Long Island](#). Progress report to the NY wine and grape foundation, January 2021.

Wise, A. 2021 [Harvest data from LI Horticultural Research and Extension Center Research Vineyard](#). CCE of Suffolk Co.

Wise, A. 2010-2020. Annual summary of Harvest Data from the LIHREC Research Vineyard. CCE of Suffolk Co., NY access at: <http://ccesuffolk.org/agriculture/grape-program/grape-research>

6. Scientific and Outreach Oral Presentations (relative to NE 1720 activities)

Martinson, T. (Presenter Only), Lake Erie Regional Grape Program Summer Conference, "Testing Loose-clustered Vignoles clones." Cornell University and Penn State University, Portland, NY. (July 25, 2013).

Wise, A. 2020. [Performance of Selections in the Long Island Wine Grape Variety Trial](#). Presentation slides online,

7. Fund Leveraging (relative to NE 1720 activities)

Martinson, T., A. Wise, and T Bates. *Documenting performance of novel wine grape cultivars and clones and disseminating research-based information to Eastern producers*. 2019-2021. Cornell Federal Capacity Funds Grant Program \$116,256.

Appendix 1:

Geneva Selections to consider for NE1720:

Bruce Reisch bruce.reisch@cornell.edu

NY03.0207.02 – This white wine grape has scored very well in wine tastings, with panelists mentioning bright acidity with notes of citrus, melon, apricot and peach. The vine has an excellent large canopy, some leaf phylloxera, and will need protection from bird depredation. The prediction for 50% bud kill is -15.7 °F.

NY03.0207.06 – This white wine selection produces a good canopy with moderate resistance to foliar powdery and downy mildews. Fruit are mostly rot-resistance but some sour rot has been noted in some years. Wines have been highly ranked by tasting panels, with aromas described as melon, pear, spicy and pineapple, while the palate descriptors included good structure and body; and mentions of citrus, pineapple apple and Riesling-like characters. The predicted temperature for 50% bud kill is -16.9 °F.

NY03.0208.09 – This white wine grape has been described as having citrus, tropical fruit, peach and pear characteristics in both the aroma and palate. It has been very well-liked by tasting panels. Vines have been moderately productive with good resistance to powdery mildew. Bird damage has been a problem and protection (netting) is needed. Some years, rachis necrosis was noted just prior to harvest. The predicted temperature for 50% bud kill is -15.4 °F

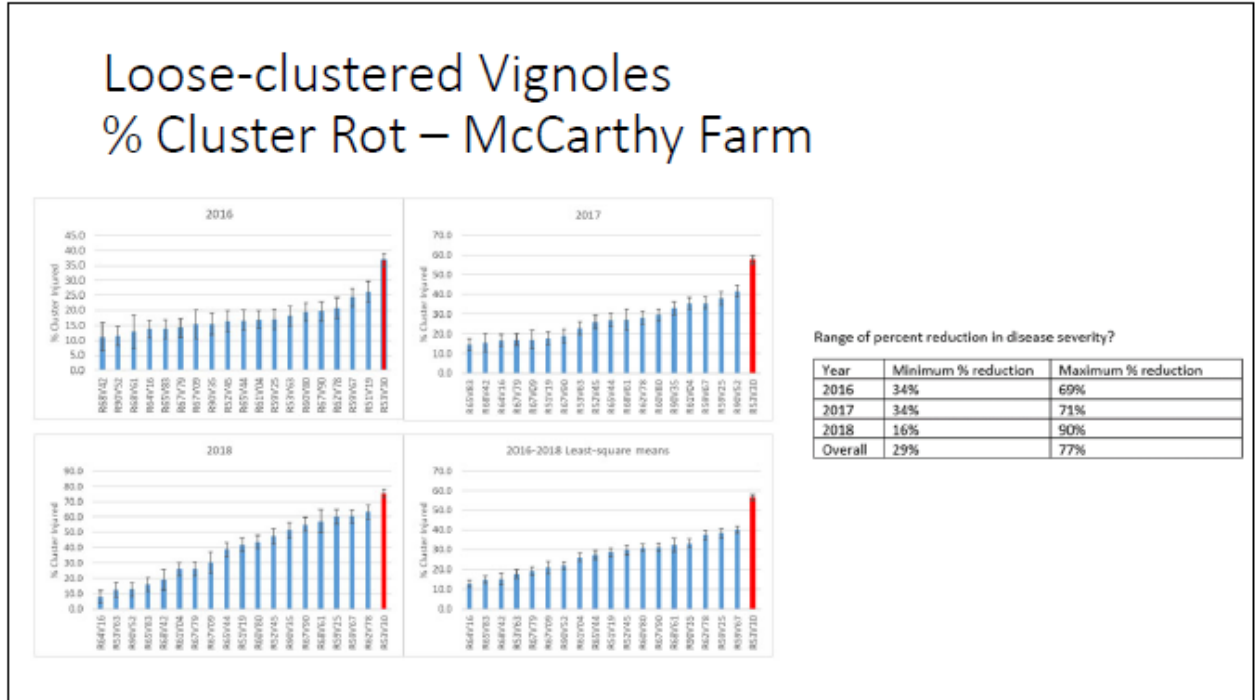
NY04.0303.02 – This is a white wine grape, which produced the top-ranked white wine from vintages 2013 and 2016. Comments included muscat, peach, spicy, tropical fruit, mango, grapefruit, dried apricot, lychee, and passion fruit. The 2016 wine had Sauvignon blanc-like tropical fruit and green notes. These vines are productive and vigorous so far, with good resistance to downy and powdery mildews under a hybrid-type spray program. The predicted temperature for 50% bud kill is -15.5 °F.

NY06.0514.06 – a highly disease resistant red wine selection. This selection carries the *Run1 / Rpv1* genes, as well as *Ren2* (for powdery mildew resistance) from *V. cinerea*. Also has excellent resistance to bunch rot, and moderate resistance to black rot. The buds are moderately winter hardy, with expected temperature of 50% bud kill in mid-winter measured to be -16.4 °F. Vines are on the small side and grafting on phylloxera-resistant stocks should be tested. Fruit yields are low, due to the use of many clusters for crossing each year. Wine descriptors are as follows: fruity with notes of blackberry, plum, cherry; slightly herbaceous, with green pepper noted; good body and medium tannin; also some have detected chocolate notes.

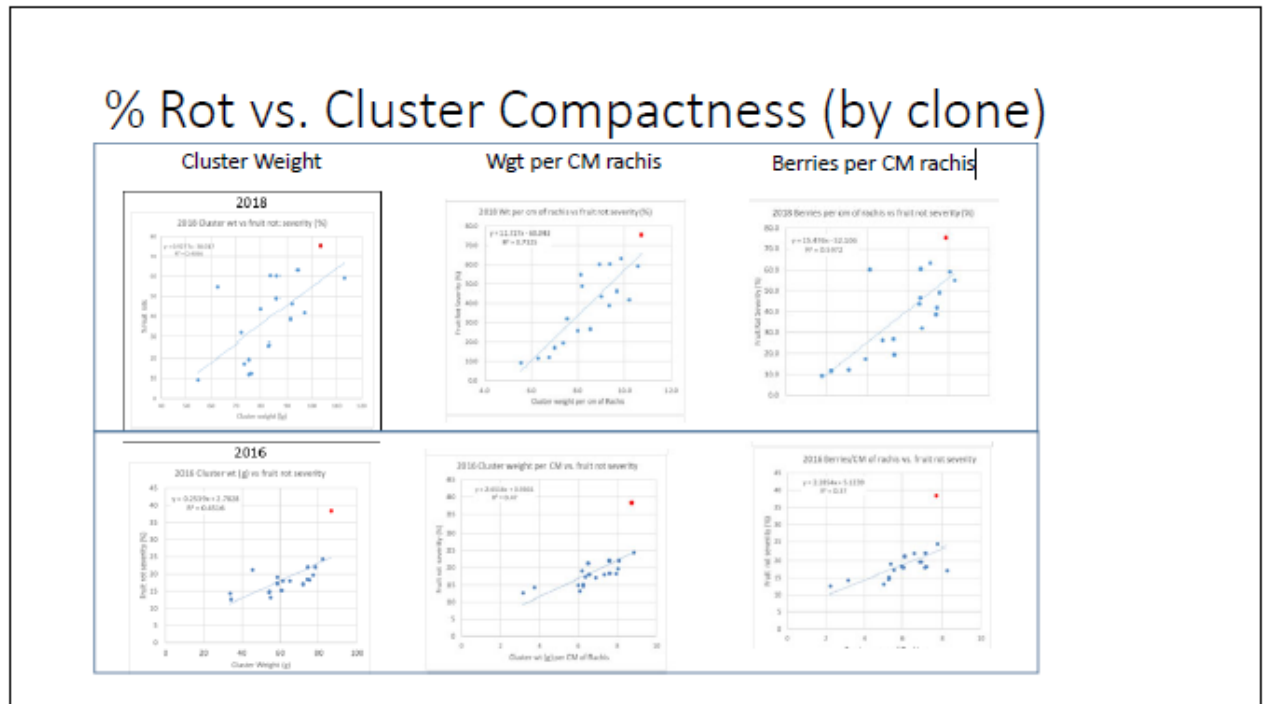
Appendix 2

Loose- Clustered Vignoles Summary:

- Data collected from 2016-2018 showed reduction in fruit rots ranging from 34-77% , compared to the 'standard clone':

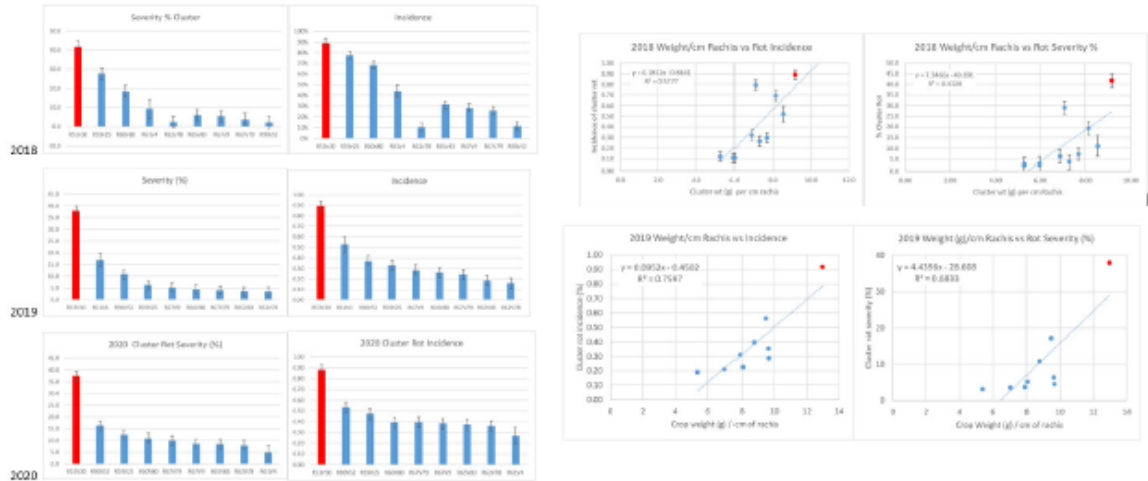


- Percentage of rot observed was correlated with cluster compactness (crop wt per cm of rachis)



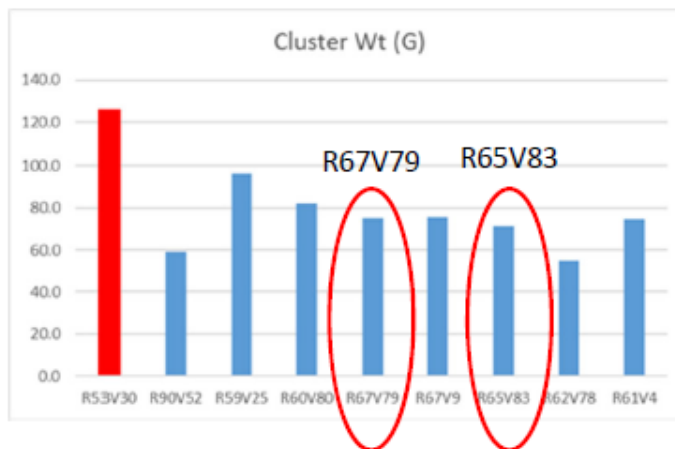
- At the Cornell Lake Erie Research and Extension Laboratory in Portland NY, 8 Loose-clustered clones were compared to the 'standard clone. Similar reductions in incidence and severity were seen from 2018-2020.

CLEREL PLANTING – 8 loose-clustered clones



4. Two clones, R67V79 and R65V83, were virus tested and found to be clean. They were propagated by Double A vineyards (grafted). They both showed significant reductions in Incidence and severity, along with smaller clusters, than the 'standard' Vignoles selection.

Clones Propagated



• Virus Tested



NE1720: MULTI-STATE EVALUATION OF WINEGRAPE CULTIVARS AND CLONES

State: Massachusetts

Author(s): Elsa Petit

Timing of Activities: January 2021 to November 2021

1. Impact Nugget:

In 2021 in MA, our main focus has been finding sustainable [economically and environmentally] solutions against diseases, pests and cold injury. The first aspect of our research on diseases focused on understanding how grape trunk disease causes disease so we can propose sustainable treatments for growers. Additionally, two trials have focused on solutions against foliar diseases and pests. One trial quantified natural resistance to the downy mildew for eight winegrape cultivars at the NE1720 plot in Belchertown. A second trial quantified the efficacy of ten organic pesticides against downy mildew and Japanese beetles at the UMass organic vineyard in Amherst. Regarding cold injury, we partnered with Black Birch Vineyard, MA and obtained a SARE farmer grant to evaluate the level of cold protection of Hybertex and plastic covers. We continued to record the timing of phenology of eight winegrape cultivars at the NE1720 plot in Belchertown to evaluate the most suitable varieties for the region. We released 23 Grape Notes newsletters reaching about 60 subscribers in 2021, presenting new research data as well as timely information about grape growing. We reached out to grape growers by presenting at five growers' meetings and giving one workshop on pruning. We updated the grape section of the New England Small Fruit Management Guide and New England Wine Grape Growers' Resource Center. Finally, we performed a Qualtrics survey for grape growers in New England during the summer 2021 to quantify the research and extension needs of the growers. Five undergraduates were trained during this past year working on the above projects.

2. New Facilities and Equipment:

NA

3. Unique Project-Related Findings:

1. Natural resistance to fungal diseases:

Our preliminary results showed that among the eight varieties tested at the MA NE1720 plot in Belchertown in 2021, varieties with the highest susceptibility to downy mildew were Corot Noir, La Crescent, Riesling and Vidal, while St. Croix showed average symptom level and Chambourcin, Frontenac, Marquette and Noiret showed the most resistance.

2. Efficacy of organic pesticides against downy mildew and Japanese beetles:
A preliminary analysis showed that among the five organic fungicides tested against downy mildew, the most efficient were Badge X2 (active ingredient: copper hydroxide and copper oxychloride) and LifegardWG (active ingredients: Bacillus mycoides isolate J*). Among the five organic pesticides tested against Japanese beetles, Surround was the most efficient.

3. Cold protection – Farmer grant:
We used the following treatments for cold protection 1) a low-tent system using both geotextile fabric and greenhouse plastics which, in limited Canadian research trials have been useful for vine protection, 2) a modified low hoop system (“trellis-hoop”) system, and that we proposed as a lower-cost, low maintenance design for cold protection, and 3) a conventional high tunnel system, which has proven cost-effective for high-value grapes. In combination with these physical protection systems, we also ran comparative tests with a novel cold hardiness-inducing treatment, ChillBan™, under development at Oregon State University. Preliminary analysis of the first year’s data showed that Hybertex performed the best for bud survival and ChillBan seems to induce flowering but did not protect from cold.

4. Accomplishments Related to each of the 3 Objectives:

Objective 2. Evaluate the viticultural and wine attributes of promising emerging cultivars and genotypes based on regional needs.

In MA in 2021, the cultivars Frontenac, La Crescent, Marquette, and St Croix reached Brix levels in the 20s by the end of September while Corot Noir, Chambourcin, Riesling and Vidal lagged behind. Levels of mortality [number of dead plants out of all plants for one variety] at the 16-year-old NE1720 planting [planted in 2005] were the highest for Riesling (60%) and Chambourcin (50%) followed by Noiret and Vidal (both 25%) and then Marquette (16%) and Corot Noir (8%). Based on these findings, we would recommend Frontenac, La Crescent, Marquette, and St Croix for planting in western MA.

5. Impact Statements:

In MA, this past year, NE-1720 is credited with:

1- increasing collaborations between researchers and industry on grapevine trunk disease: This past year, one of our focus was educating growers about grapevine trunk diseases on new cultivars as we had an active grant to research the mechanism of the disease and ways to manage it. [PI: B. Goodell, Collaborators: J. Jellison, E. Petit, American Vineyard Foundation,

2019-2275 Role of LMW fungal metabolites in Eutypa dieback, 2019-2021, \$70,000].

We have given one talk at a grape growers' meeting [Date: 1/13/2021 - Over zoom - Massachusetts Fruit Growers Association Annual Meeting 2021: "Through the grapevine in Massachusetts in 2020: updates and new research" - 100 attendees] to present the finding of our research. We have released one publication [Gabriel Perez-Gonzalez, Dana Sebestyen, Elsa Petit, Jody Jellison, Laura Mugnai, Eric Gelhaye, Norman Lee, Sibylle Farine, Christophe Bertsch, Barry Goodell. 2021. The Role of Low Molecular Weight Fungal Metabolites in Grapevine Trunk Disease Pathogenesis: Eutypa Dieback and Esca. Preprint]. Understanding the pathogenesis of grape trunk diseases (GTDs) is the key to the development of disease control and treatment.

2- increasing collaborations between researchers and industry on protection against cold damage: We received a Northeast SARE Farmer Grant to evaluate different ways to better protect grapes from cold. [PI Ian Modestow, Northeast SARE Farmer Grant, Protecting European Grape Vines from Cold Weather Damage in New England, 2020-2021 Award number: FNE20- 959-34268, Amount awarded: \$13,698].

We have set up the trial in Fall 2020 and taken data on the effect of the different treatments in 2021. We have shown that Hybertex fabrics increased bud survival better than single or double plastic.

3- identifying and characterizing viticultural microclimates.

We continued to monitor, at our experiment station plot, the timing of key developmental stages such as bud break, flowering and veraison on the various grape cultivars. Based on our findings, we would recommend Frontenac, La Crescent, Marquette, and St Croix for planting in western MA.

4- increasing undergraduate learning opportunities around viticulture. This past year, an undergraduate student, Elsie Murphy, received a fellowship from the Center for Food, Agriculture and the Environment to work on a resistance to diseases in different grape varieties. One undergraduate was involved in the evaluation of organic products efficacy against downy mildew and Japanese beetles. Badge X2 (active ingredient: copper hydroxide and copper oxychloride) and LifegardWG (active ingredients: Bacillus mycoides isolate J*) were the most efficient organic fungicides against downy mildew. Surround was the most efficient pesticide against Japanese beetles.

Two undergraduates were involved in the write up of 23 Grape Notes newsletters and the updates of the grape section of the New England Small Fruit Management Guide and the New England Wine Grape Growers' Resource Center.

5- maximizing the potential productivity and quality of this new germplasm. We have continued to evaluate the effect of shoot and fruit density on juice quality.

6. Published Written Works (*relative to NE-1720 activities*)

Gabriel Perez-Gonzalez, Dana Sebestyen, Elsa Petit, Jody Jellison, Laura Mugnai, Eric Gelhaye, Norman Lee, Sibylle Farine, Christophe Bertsch, Barry Goodell. 2021. The Role of Low Molecular Weight Fungal Metabolites in Grapevine Trunk Disease Pathogenesis: Eutypa Dieback and Esca. Preprint

Ware, L., Garofalo, E., Petit, E., and Piñero, J.C. 2021. Does the Red Color Enhance Spotted Wing Drosophila Response to Traps Baited with Diluted Concord Grape Juice? Fruit Notes 86: 15-16.

7. Scientific and Outreach Oral Presentations (*relative to NE 1720 activities*)

A. Field days/ Growers' meetings:

1. Date: 1/13/2021 - Over zoom - Massachusetts Fruit Growers Association Annual Meeting 2021: "Through the grapevine in Massachusetts in 2020: updates and new research" - about 100 attendees
2. Date: 4/13/2021 - Over zoom - Fruit Twilight Meeting – “April updates on viticulture in MA” – about 100 attendees
3. Date: 5/6/2021 - Over zoom - Fruit Twilight Meeting - “May updates on viticulture in MA” – about 100 attendees
4. Date: 7/14/2021 - In person at Clarkdale Fruit Farms - Massachusetts Fruit Growers Association – “Midyear updates on field trials on grapes” – about 100 attendees
5. Date: 7/22/2021- In person at Cold Spring Orchard - Summer Scholars Field Trip - “Trial on disease resistance in the NE1720 plot” – about 50 attendees

B. Workshop: Date: 1/30/2021 - Over zoom - MassAggie pruning workshop 2021 – about 90 attendees

8. Fund Leveraging (*relative to NE 1720 activities*)

PI:H.Sandler,USDA-NIFA-EIP, Integrating development, implementation and awareness of effective strategies and technologies to promote Specialty Crop IPM in Massachusetts - Sept 1, 2021-August 31, 2024. Amount: \$817,708

PI: J. Pinero, National Institute of Food and Agriculture - Undergraduate Research and Extension Experiential Learning Fellowships -Engaging Undergraduates in Research and Extension Training using Experiential Learning and Technology to Enhance the Sustainability of Food Production Systems”. Amount: \$708,069

NE1720: MULTI-STATE EVALUATION OF WINEGRAPE CULTIVARS AND CLONES

State: Michigan

Author(s): Esmaeil Nasrollahiazar

Timing of Activities: December 2020 to November 2021

1. Impact Nugget:

Cold damage is a prominent environmental challenge in high-latitude grape producing regions such as Michigan, and we anticipate that this study will assist the Michigan grape industry in minimizing cold damage. We have conducted cold hardiness evaluation through dormant season in 2020-2021 in Northwest and Southwest of Michigan. The Objectives of this study was 1) Monitoring and providing weekly bud cold hardiness updates of grape varieties in Michigan. In the northwest, the testing have be done on 10 grapevine cultivars, ranging from very cold-tender *V. vinifera* (ex. Merlot), moderately cold tender *V. vinifera* (ex. Riesling) to more cold-hardy grapes (e.g. Cabernet Franc) The focus will be on cultivars.

Each week, budwood from different vineyards of NW Michigan analyzed for low temperature exotherms (LTE) and we started modeling the relationship of the previous year's Growing Degree Day as an indicator of grapevine cane/bud maturity, and bud freezing tolerance (using differential thermal analysis). The results of the cold hardiness evaluation were published for the region growers. 2) Our second objective of the project is establishing cold-hardiness limits of a range of grape varieties in Michigan to inform planting choices and site selection and the results will help newcomers to select appropriate cultivars and sites in planting new vineyards. 3) Our final goal would be Developing Michigan Grapevine Cold Hardiness Model (MGCHM).

The cold hardiness evaluation project have done at the MSU Northwest Horticulture Research Center in Traverse City Michigan. This project is funded by AABI Programming (Project GREEN) and supported by several growers and wineries.

Southwest Michigan:

Equipment and methodology for testing cold hardiness of grape cultivars by differential thermal analysis (DTA) were implemented at the Michigan State University SW Michigan Research and Extension Center. 11 grape wine and juice cultivars, ranging in baseline cold hardiness, at 10 locations in SW Michigan were evaluated weekly in the dormant season (December 2020 to April 2021) for their bud cold hardiness.

New Facilities and Equipment:

Northwest Michigan:

In winter 2020-2021 the following equipment have been purchased:

- Keithley data collector
- Tektronic software Kickstart
- Tenny temperature chambers
- Thermal analysis plates

2. **Unique Project-Related Findings:** Last year was first year of the project and I had a chance to assembled Thermal analysis plates, collaborate and set up the test. In winter 2021, NW Michigan, we had an extreme cold event in February. The cold event caused 8 to 15 % primary bud kill on some cold tender Vitis vinifera cultivars. Primary buds mortality has been observed in Merlot, Teroldego, and Refosco cultivars at 15%, 8%, and 10%, respectively.

3. **Accomplishments Related to each of the 3 Objectives:**

4. **Impact Statements:**

Providing cold hardiness updates and services that informed Michigan grape growers about the cold tolerance of a specific cultivar helped them respond to a weather event more proactively with mitigation strategies such as wind machines, heaters, or nanoparticle protectants.

In 2021, by providing cold hardiness updates, the growers adopted compensatory pruning strategies to minimize crop loss due to the cold event in NW Michigan.

5. **Published Written Works (*relative to NE-1720 activities*)**

Freezing stress, cold hardiness and managing winter damaged vines

Paolo Sabbatini, Michigan State University, Department of Horticulture, and Esmaeil Nasrollahiazar, Michigan State University Extension - February 23, 2021

6. **Scientific and Outreach Oral Presentations (*relative to NE 1720 activities*)**

Esmaeil Nasrollahiazar, Register for the 2021 Michigan Statewide Grape Spring Kickoff webinar on March 23

7. **Fund Leveraging (*relative to NE 1720 activities*)**

AABI Programming, Project GREEN, \$12,500 - December 1, 2020- May 31, 2021

NE1720: MULTI-STATE EVALUATION OF WINEGRAPE CULTIVARS AND CLONES

State: Minnesota

Author(s): Matthew Clark

Timing of Activities: January 2021 to November 2021

1. **Impact Nugget:** Educated over 120 grape growers and wine producers on best practices using an online conference format (Cold Climate Conference).

2. **New Facilities and Equipment:** Acquired Good Nature X1 fruit press for use on small batch wine making (white wines) and cider evaluation.
<https://www.goodnature.com/juice-presses/x1/>

3. **Unique Project-Related Findings:** Preliminary grower evaluation of table grape breeding lines is favorable. Grower asked ~30 customers to provide feedback and the majority (97%) indicated an interest in purchasing if available.

4. **Accomplishments Related to each of the 3 Objectives:**

- 1. Screen the viticulture characteristics of clones, cultivars and elite germplasm with significant potential throughout the USA.**

The University of Minnesota does not have a dedicated (replicated) NE1720 or NE1020 vineyard for evaluation. However, the breeding program contributes germplasm for evaluation to the different sites. We report on key varieties and advanced breeding selections grown at the Horticultural Research Center during NE1720 meetings and state reports. In 2021, we did acquire some new materials for evaluation in breeding from Clean Plant Center Northwest.

- 2. Evaluate the viticultural and wine attributes of promising emerging cultivars and genotypes based on regional needs.**

Ongoing grape breeding research onsite for evaluation of new cultivars, advanced selections, and seedlings. This year we increased our culling rate by roughly 50% to overcome a bottleneck in the breeding pipeline. Discarding advanced selections that no longer show promise as new cultivars or breeding parents. Continue to propagate and distribute advanced materials. Plans to release MN1220 have resulted in distribution of materials, including virus free stock, to nurseries and tissue culture propagators.

- 3. Conduct explorations of new germplasm and lesser-known cultivars that may have economic potential for the US wine industry.**

Powdery mildew “REN stack” germplasm will be accessioned into the Foundational Plant Services (Davis, California) and made publicly available. The transfer of materials are slated for November 2021. These plants have multiple R-genes for powdery mildew resistance in collaboration with USDA-ARS, Cornell University, and the University of Minnesota as part of the VitisGen2 project (USDA-NIFA).

5. Impact Statements:

Reached over 120 grape grower and wine producers on best practices for growing cold hardy grapes including presentations from NE1720 state representatives and Extension personnel

6. Published Written Works (*relative to NE-1720 activities*)

Yin, Lu, Avinash Karn, Lance Cadle-Davidson, Cheng Zou, Anna Underhill, Paul Atkins, Erin Treiber, Daniel Voytas, and Matthew Clark. "Fine mapping of leaf trichome density revealed a 747-kb region on chromosome 1 in cold-hardy hybrid wine grape populations." *Frontiers in plant science* 12 (2021): 150.

Yin, Lu, Eric C. Burkness, William D. Hutchison, and Matthew D. Clark. "Effects of Foliar Phylloxera (Hemiptera: Phylloxeridae) Infestations on Wine Grape Photosynthesis, Yield, and Fruit Quality." *Journal of Entomological Science* 56, no. 4 (2021): 504-518.

Olson, Jack, and Matthew Clark. "Characterization of Anatomical and Physiological Effects of Variegation Mutation on Grapevine." *HortScience* 56, no. 10 (2021): 1251-1257.

Moreira, L. and M. Clark (2021) Embryo rescue of cold-hardy table grapes. *HortScience* 56(9): 1059-1065

7. Scientific and Outreach Oral Presentations (*relative to NE 1720 activities*)

Clark, MD. 2021. Panelist: Future Grape Cultivars for Eastern North America. ASEV-ES Virtual Conference.

Moreira, L., Z. Vickers, E. Treiber, Anna Andresen and M. Clark, and A. Hegeman. (2021) A procedure to investigate flavor in large grape samples. ASHS Conference. Denver, CO. August 7, 2021

8. Fund Leveraging (*relative to NE 1720 activities*)

Genetic Improvement of Hybrid Grape Quality Traits

Specialty Crop Block Grant (Mn Dept Ag)

Project Team: Matthew Clark (Principal), Adrian Hegeman (Co-Investigator)

Project Dates: November 5, 2020 - October 31, 2022

\$99,930

Enabling Rapid Molecular Diagnostics of Trunk Diseases for Minnesota Fruit Farms

Specialty Crop Block Grant (Mn Dept Ag)

Project Team: Matthew Clark, Annie Klodd, Bob Blanchette

Nov 1 2021- Oct 31 2023

\$131,811

NE1720: MULTI-STATE COORDINATED EVALUATION OF WINEGRAPE CULTIVARS AND CLONES

State: Missouri

Author(s): Dean S. Volenberg

Timing of Activities: January 2021 to November 2021

1. **Impact Nugget:** Two wine grape replicated trials were established in May and June 2021. A wine grape cultivar and advanced wine grape breeder selections trial was established at the South Farm Research Center, Columbia, MO in May 2021. This trial contains 41 cultivars and or advanced breeder selections. The other trial was established at the Horticulture and Agroforestry Research Center, New Franklin, MO in June 2021. This trial contains Norton, Chardonal and Vidal blanc that have various viruses, virus combinations or virus free. The trial was undertaken to assess the potential of viruses or virus combinations on fruit yield, fruit quality, vine vigor and vine longevity. Previous research has shown that some viruses such as Grapevine red blotch virus and Grapevine leafroll virus-3 or their combination does not result in symptomology in hybrid grape cultivars such as Norton. Grape growers want to know how viruses or virus combinations are impacting grapevines and fruit yield and quality.
2. **New Facilities and Equipment:** A 40x60-square-foot building is being constructed at the South Farm Research Center Vineyard. The building will provide us the opportunity to house and maintain our vineyard equipment. Additionally, the building will provide us an opportunity to have an area that is climate controlled for small gatherings.
3. **Unique Project-Related Findings:** Weekly fruit samples from Norton grapevines identified as being virus-free or infected with GRBV or GLRaV-3 were compared. Over a 7-week period starting prior to veraison to harvest brix, pH, TA and berry weight were similar. Suggesting that GRBV or GLRaV-3 of infected Norton grapevines is not impacting berry weight or fruit quality.
4. **Accomplishments Related to each of the 3 Objectives:**

Objective 1

A replicated cultivar trial was planted in May, 2021 consisting of 41 cultivars and or advanced breeder selections. Notable breeder selections are two red selections from grape breeder Ed Swanson, loose clustered Vignole selections from USDA, Cornell NY, and a white selection of Norton x Cabernet sauvignon from Wenping Qiu, Missouri State University.

Objective 2

The Missouri Grape and Wine Institute is currently in the process of hiring a Extension Enology Faculty position. The successful candidate will oversee small-batch wine production from the cultivar trial.

Objective 3

Bud wood is being sourced from Foundation Plant Services of grape cultivars from the Republic of Georgia and will be grafted to suitable rootstocks. These selections will be established in the replicated cultivar trial in April 2022.

5. **Impact Statements:**

The establishment of the wine grape cultivar trial will inform the Missouri grape and wine industry of the potential of grape cultivars that are not currently cultivated in Missouri. Inclusive in the trial are nine *V. vinifera* wine grape cultivars. Additionally, the cultivar trial will provide grape breeders much needed data on performance of advanced breeder selections. The cultivar trial is dynamic which will result in grape cultivars or breeder selections being added and removed over time.

The establishment of a replicated trial of grapevine cultivars infected with no viruses, GRBV, GLRaV-3 or the combination of GRBV with GLRaV-3. The results will have important implications for Missouri grape growers since a recent survey of commercial vineyards throughout Missouri determined that GLRaV-3 and GRBV were present in 53% and 35% of the samples, respectively. Yet, most all infected grape cultivars except Crimson Cabernet (Norton x Cabernet Sauvignon) do not display typical GRBV or GLRaV-3 symptomology as documented in *V. vinifera* cultivars.

6. **Published Written Works** (*relative to NE-1720 activities*)

Schoelz, J., D. Volenberg, M. Adhab, V. Klassen, C. Spinka, and M. Al Rwahnih. 2021. A Survey of Viruses Found in Grapevine Cultivars Grown in Missouri. *Am J Enol Vitic* 72:73-84.

7. **Scientific and Outreach Oral Presentations** (*relative to NE 1720 activities*)

None to report.

8. **Fund Leveraging** (*relative to NE 1720 activities*)

The Missouri Wine and Grape Board provided \$10,000 for the establishment of a replicated cultivar trial in 2021.

NE1720: MULTI-STATE EVALUATION OF WINEGRAPE CULTIVARS AND CLONES

State: South Dakota

Author(s): Anne Fennell

Timing of Activities: January 2021 to November 2021

1. **Impact Nugget:** New selections from University of Minnesota and North Dakota State University expand and improve our industry choices for quality cold climate cultivars.
2. **New Facilities and Equipment:** New vineyard site (1.75 acres) with trellis and trickle irrigation.
3. **Unique Project-Related Findings:**
 - a. Bud viability in Brianna, Frontenac and Marquette was similar for both spur (2 node) and short cane (4 node) balance pruned vines.
 - b. Clusters size was greater for Brianna and La Crescent for short cane than spur balance pruned vines.
 - c. Spur pruned Frontenac, Marquette and La Crescent had greater soluble solids than short cane pruned vines. In contrast Brianna had greater soluble solids in short cane than spur pruned vines.
 - d. Brianna, Frontenac gris, La Crescent and Marquette showed a correlation with freezing tolerance and minimum temperatures in 7 days prior to testing. Marquette had the greatest freezing tolerance throughout the entire dormant season.
 - e. Brianna, Frontenac gris, La Crescent and Marquette buds receiving chilling in field conditions broke bud at lower field chilling hour accumulation than those receiving a constant 4 °C.
4. **Accomplishments Related to each of the 3 Objectives:**
 1. Cold climate cultivars Brianna, Frontenac, Marquette and La Crescent were evaluated for freezing tolerance and productivity under different pruning methods.
 2. New selections from University of Minnesota (Itasca, MN1369, MN1325, MN1280) and North Dakota State University (ND213 and ND054) have been propagated and established in new vineyard for evaluation.
5. **Impact Statements:**

Changing climatic conditions in fall are showing different strengths and weaknesses in cold climate cultivars in SD industry vineyards requiring expanded testing for freezing tolerance, dormancy and chilling fulfillment relative to vineyard.

6. Published Written Works (*relative to NE-1720 activities*)

Yilmaz T, Alahakoon D, Fennell A (2021) Freezing tolerance and chilling fulfillment differences in cold climate grape cultivars. Horticulturae 7:4 doi.org/10.3390/horticulturae7010004.

Yilmaz T, Fennell A (2021) Spur and short cane pruning influence bud viability, yield, and fruit quality. Proceedings of the South Dakota Academy of Science 100:95-105.

7. Scientific and Outreach Oral Presentations (*relative to NE 1720 activities*)

Fennell A. Cold climate cultivars for upper midwest. Fermentation, Brewing and Spirits class, February 2021.

Fennell A. Field tour of grape genetics. Brookings Area Master Gardeners Tours, June 26, 2021.

Fennell A. Cold climate cultivars fruit characteristics. Local Foods Education Center, Brookings SD, September 13, 2021.

8. Fund Leveraging (*relative to NE 1720 activities*)

NE1720: MULTI-STATE EVALUATION OF WINEGRAPE CULTIVARS AND CLONES

2021 Report

State: Vermont

Author(s): Terence Bradshaw, Sarah Kingsley-Richards, & Jessica Foster

Timing of Activities: 10/1/2020 – 9/30/2021

1. Impact Nugget:

The Vermont grape and wine industry has increased from essentially zero to 165 acres of grapes in 2021 with an estimated value in direct wine production of \$4-5 million. This growth is attributable to relatively new, cold-hardy cultivars with high potential for wine quality which did not exist until the 1990s. Expanded evaluation of new cultivars will improve wine quality and increase sales of locally-produced wine.

2. New Facilities and Equipment:

A new cultivar trial vineyard following NE-1720 protocols was established by the investigator in 2016, containing the following cultivars: Crimson Pearl, Petite Pearl, Verona, St Pepin, and MN 1285. Solid rows of Brianna, Louise Swenson, Marquette, and Marechal Foch were also installed to facilitate future research.

3. Unique Project-Related Findings:

In this new evaluation, five cultivars (Crimson Pearl, Petite Pearl, Verona, St Pepin, and MN 1285) were planted in a randomized, replicated trial, and four solid rows of Brianna, Louise Swenson, Marquette, and Marechal Foch were also planted to evaluate management practices on those cultivars. In 2018-2019, vines were managed without fungicide applications to evaluate natural susceptibility to disease. No cultivars were consistently disease-free, and all exhibited some degree of black rot and powdery mildew infection. Relative susceptibility to disease was not consistent across both years, but 'Brianna' had greater incidence of black rot and 'Louise Swenson' showed lower incidence of powdery mildew in both years. The relatively new cultivars 'Crimson Pearl' and 'Verona' exhibited comparatively moderate disease susceptibility overall.

Crop yield remains relatively low for some cultivars. Marechal Foch had the greatest mean yield in 2021 with 8.4 kg per two-vine panel (~3.5 tons/acre), whereas some less-vigorous cultivars, e.g., Crimson Pearl, Louise Swenson, and Brianna, had less than one tone per acre equivalent yield. Brianna has suffered from crown gall in previous years and was largely cut back to the ground in 2020 to manage that disease. Louise Swenson has been under-vigorous at this and other nearby sites in prior plantings, typically until the fourth or fifth year from planting when it catches up with other cultivars. In this

planting, Crimson Pearl appears to have a similar tendency. However, the no-spray management in the first three years of growth likely reduced overall growth for this and other cultivars. Juice quality for winemaking was acceptable, with chaptalization, for all cultivars. Of particular note is that all cultivars except Marquette had juice titratable acidity below 1.01 g/100 ml.

4. Accomplishments Related to each of the 3 Objectives:

1. Screen the viticulture characteristics of clones, cultivars and elite germplasm with significant potential throughout the USA.

NA

2. Evaluate the viticultural and wine attributes of promising emerging cultivars and genotypes based on regional needs.

Grapevines were evaluated for vegetative growth and fruit production and quality. All vines were evaluated for disease susceptibility under no-spray conditions in 2018-2019, and what fruit were produced were included in those evaluations. Crop yield and quality data to managed, productive vines will be collected 2020-2025.

Data on disease incidence were published in 2021. Results from that work were incorporated, into the redesign of our fact sheet UVM FRT 003: Relative Disease Ratings for Wine Grape Varieties Grown in Vermont.

Vine growth, crop yield, and juice quality are preliminary at this point. Written summaries of these data will be posted to UVM Fruit Program website in early 2022.

3. Conduct explorations of new germplasm and lesser-known cultivars that may have economic potential for the US wine industry.

N/A

5. Impact Statements

In the 1990s, there was no grape or wine industry in Vermont, but by 2016, winegrapes were grown on 165 acres and wine was valued at over \$5 million annually. Continued refinement of cultivar breeding and selection for unique cold-climate regions will increase the quality of wines made and the economic impact of wineries in the region.

6. Published Written Works (*relative to NE-1720 activities*)

Hazelrigg, A. L., T. L. Bradshaw and G. S. Maia. 2021. "[Disease Susceptibility of Interspecific Cold-Hardy Grape Cultivars in Northeastern U.S.A.](#)" Horticulturae 7(8): 216. Special issue on Grape Responses to Abiotic and Biotic Stresses. DOI:10.3390/horticulturae7080216

Bradshaw, T. (lead author). 2021. Grapes and Wine. Vermont Sustainable Jobs Fund Farm to Plate 2.0 Product Brief. Issue briefs drafted by statute for presentation to Vermont legislature in 2019-2020 session.

<https://www.vtfarmtoplate.com/assets/resource/files/Vermont%20Food%20System%20Plan%20Product%20Brief%20Grapes.pdf>

Bradshaw, T. UVM Fruit Website, <http://www.uvm.edu/~fruit>. Outreach website for tree fruit and viticulture-related horticultural and IPM information for commercial growers. Affiliated blog archives 12 email postings made to grape producer listserv (275 subscribers) during reporting period.

7. Scientific and Outreach Oral Presentations (*relative to NE 1020 activities*)

NA

8. Fund Leveraging (*relative to NE 1720 activities*)

Evaluating systems components for orchard and vineyard crops in Vermont. Vermont Agriculture Experiment Station Hatch Grants Program, Oct 2020 -Sep 2025. \$63,942. PI: T. Bradshaw

VitiNord 2022: A pivotal opportunity for education, collaboration, and innovation among Vermont grape and wine producers. USDA/Vermont Agency of Agriculture Specialty Crops Block Grants Program. PI: T. Bradshaw. October 2021 – March 2023. \$20,548.

Vermont IPM Extension Implementation Program: 2021-2024. USDA CPPM EIP. PD: A. Hazelrigg. Co-PIs: S. Bosworth, T. Bradshaw, H. Darby, M. Skinner. August 2021 - July 2024. \$499,574 total, \$91,677 for Fruit emphasis area.