

**Virginia Wine Board Grant  
Final Report, Year Two (FY23-24)**

05/31/2024

Project Lead: Emily Hodson

Organization: Winemaker's Research Exchange- Grape Breeding Program (ViRV)

Address: 325 Winding River Lane, Charlottesville, VA 22911

*Title:* Groundwork for Development and Management of a Virginia Focused Wine Grapevine Breeding Initiative

*Proposal Number:* [Proposal Number]

*Project Type:* ☒ Research ☐ Education ☐ Marketing

Is this a multi-year grant? ☒ Yes ☐ No

If yes, which year does this report address? This completes year two (FY23-24) of five.

*Original FY23-24 Funding Amount:* \$209,407.46

*Amended FY23-24 Funding Amount:* \$226,919.76

*Remaining FY23-24 Balance:* \$0.00

***Objectives and Results:***

**Project Goal:** Breed vinifera-style wine grapes adapted to the Mid-Atlantic US with a specific focus on combining vinifera fruit quality with downy mildew resistance, with a goal of commercializing the resulting varieties within 10-15 years.

**Objectives:** Define breeding goals precisely, including the highest priority traits and target wine quality. Identify advanced germplasm with downy mildew resistance, preferably introgressed into a high percentage vinifera background, and establish an evaluation/breeding block. Use marker assisted breeding for early selection of seedlings with multiple resistance loci and participatory breeding for evaluation of fruit.

These portions of the research project objectives have been reached:

- Guided development of industry-driven breeding goals to be precisely defined and achievable over near term given existing germplasm and DNA markers.
- Defined the breeding goals precisely, including the highest priority traits, including examples of existing varieties with the desired quality characteristics.
- Identified advanced germplasm with downy mildew resistance, introgressed into a high percentage vinifera background, and established an evaluation/breeding block and nursery block.
- ARS has provided land, infrastructure, greenhouses, growth chambers and resources necessary for the genotyping, phenotyping and evaluation of breeding lines for the project.

These objectives are ongoing:

- Made crosses to generate seed representing modified BC2 (Backcross Two-second generation backcross to vinifera) and beyond, targeting commercial fruit quality in BC3 or BC4.

- Used a combination of DNA markers and phenotypic selection to eliminate undesirable seedlings that lack either the desired resistance alleles or necessary viticultural characteristics.
- Share improved germplasm among Agricultural Resource Services breeding and research programs.

These objectives have not yet been completed due to the long term nature of this project:

- Select two to four varieties to be patented and licensed
- File invention disclosures for two to four varieties selected by the Winemaker's Research Exchange.
- Establish multi-location replicated plantings of elite breeding lines and evaluate viticultural characteristics and fruit quality, including microvinification for wine sensory evaluation.

### ***Overall Benefit for Virginia Wine Industry:***

No other grape breeding program in the U.S. is developing vinifera-style wine grapes with resistance to downy mildew, nor other humid-climate diseases of economic importance to the Mid-Atlantic. ARS-Parlier, ARS-Geneva, and VitisGen partners have developed resistant germplasm with initial backcross generations into *V. vinifera* tracked by DNA markers, and have elucidated the genetic basis of host resistance via Quantitative Trait Locus (QTL) mapping and genome editing. ARS and the Virginia Wine Board share a long-term interest in studying the genetics of downy mildew resistance in germplasm. Thus, this project is designed to make rapid and targeted progress for the Virginia wine industry. The goal of this program is to develop two to four new grape varieties appropriate for Virginia and the Mid-Atlantic. A successful variety would be one with high vinifera parentage (> 90%) that correlates to high wine quality and consumer acceptance. Its genetic makeup would also offer resistance to the primary challenges of our regions, specifically the fungal pathogen Downy Mildew. These regional "brand name" grape varieties will gain popularity as competitive pricing and high wine quality will allow the industry to grow and evolve steadily with the rest of the winegrowing regions of the world, while minimizing environmental impacts.

### ***Publications and Activities Associated with Project:***

#### **Presentations to the Virginia Wine Board**

August 14th, 2023 [VWB Update 8.14.23](#)

December 4th, 2023 [VWB Update 12.3.23](#)

March 26th, 2024 [VWB Update 3.26.24](#)

#### **Activities Associated with the Project:**

2022

- Established a Grape Breeding Team and put a Grape Breeding Board into place.
- Stakeholder Focus Groups were completed and an Industry wide survey was developed and completed for Breeding Board guidance.
- Cooperative Research and Development Agreement put into place with USDA-ARS in April of 2022 with the title of Breeding Downy Mildew Resistant Vinifera-Style Wine Grapes Adapted to the Mid-Atlantic United States.

- Initial breeding crosses were completed with pollen crosses and germplasm acquired working with breeding board members, USDA partners, and other affiliates.
- In July Dr. Sapkota presented 'Designing, Building and Implementing a grape breeding project in Virginia' at the NatureServ Conference.
- Site Selection was completed for 2023 planting of our first generation crosses, as well as laboratory space planning at USDA-ARS Kearneysville. The facility has 20 research labs and plenty of available space so we are working on our wishlist of space and equipment for the project.
- Harvested crosses and did seed selection in September and currently have 7,000 seeds on stratification.
- Dr. Sapkota presented a grape breeding update at Cornell Agritech Seminar in September.
- Grape Breeder Surya Sapkota moved from Geneva to the Kearneysville USDA-ARS in December.
- Secured supplies for seed germination and establishing an experimental vineyard installation in Spring of 2023 at the USDA-ARS.

#### 2023

- Germinated seedlings
- Sent off seedling material for phenotypic analysis
- Dr. Sapkota presented project progress to the Virginia wine industry at the VVA
- Installed trellis and prepared field for planting
- Second season of crosses and with seed selection in September and currently have 3,000 seeds on stratification for 2024.
- Planted germinated seedlings
- Collected pollen and did a second round of crossings for planting in 2024
- Installed irrigation in the experimental vineyard at the ARS
- Dr. Sapkota presented to USDA stakeholders at Field Day Conference at the USDA-ARS Appalachian Fruit Research Station
- Dr. Sapkota presented at the Virginia Wineries Association technical conference
- Met with Tim Reinhart Specialty crop National Program Leader to review progress and look to developments for the future.

#### 2024

- Germinated second crossings for planting in Spring of 2024
- Collected pollen and did a third round of crossings for planting in 2025
- Wrote letters to delegates to support Legislative funding for Grape Breeding
- Attended Vitisgen 3 meeting, representing the East coast on advisory panel
- Met with the Virginia Wine Marketing Office to update progress and initiate collaboration
- Dr. Sapkota presented at the VVA at the Winter technical conference
- Grape Breeder continues to network with the Virginia growers and USDA
- Met with Vitisgen social scientist Changyan Yue regarding the future of marketing new varieties as they are released
- Met with Ganyuan Zhong, research leader, grape genetics unit at USDA in an effort to acquire more resources from his unit

*Future Work:*

- Sample for DNA collection of existing ascecions
- Seed selection for third generation of crossings (BC3)
- Phase 2 planting of second generation of crosses
- Acquire a phytopathobot robot
- Vineyard labeling with QR codes

*Final FY23-24 Budget and Justification:*

Item Type	Original Awarded Amount	Amended Awarded Amount (12/12/23)	Final Amount Spent
Personnel	[\$0.00]		[\$0.00]
Fringe	[\$0.00]		[\$0.00]
Travel	[\$0.00]		[\$0.00]
Supplies & Materials	[\$0.00]		[\$0.00]
Contractual	\$209,407.46	\$226,919.76	\$226,919.76
Other	[\$0.00]		[\$0.00]
<b>Total</b>	<b>\$209,407.46</b>	<b>\$226,919.76</b>	<b>\$226,919.76</b>

The original budget is in line with the final budget as the payments were made quarterly to the USDA to fulfill the terms of the CRADA.