

Virginia Wine Board Grant Report Template

1.0 INSTRUCTIONS

Use this grant report template to communicate progress on your project objectives to the Virginia Wine Board and its administrative agents.

This simplified form focuses attention on the intended and achieved results of the project, including how project results are separately shared with their intended beneficiaries. This report is not the place for a detailed technical discussion of research methodology or results.

- During the proposal stage, applicants complete the first (WHITE) sections to summarize the project's objectives, deliverables, and intended impact plus planned communication to stakeholders.
- At the midpoint of the project (December 1, due December 15), Research and Education grantees complete the center (GRAY) sections to note progress as well as expenditures to date.
- Finally, upon project conclusion (May 31, due June 30), all grantees complete the final (BLUE) sections to describe the project's results and communication, as well as final expenditures.

2.0 GRANTEE INFORMATION

Project Title		Comparing annual and perennial legumes as under-vine cover crops in Virginia vineyards					
Organization		Virginia Tech					
VWB Proposal #		26-21	Proposal # (if needed)		PRT7IWRC	Award # (if needed)	
Project Lead			Mailing Address			Research	◊ X
Name	Drew Harner		AHS Jr. AREC			Education	◊
Title	Assistant Professor of Viticulture, Extension Specialist		595 Laurel Grove Rd.			Marketing	◊
Email	dharnet@vt.edu		Winchester, VA 22602			Recurring?	◊
Phone	540-232-6050					Continuing?	◊X
						Year	1 of 2

3.0 PROJECT OBJECTIVE, PROGRESS, AND IMPACT

3.1 PROPOSAL (February)

Identify the specific deliverable or result that the project will produce. (1-2 sentences or bullets; Narrative section I.b.)

The project will produce recommendations for using individual annual and perennial legume species as under-vine cover crops in commercial vineyards, depending on production goals (i.e., reducing grapevine vigor, weed control, improving soil composition, etc.). These recommendations will be provided in 1 Cooperative Extension-styled bulletin or similar short publication, in addition to 1-2 peer-reviewed academic journal articles. Additionally, this project will provide further insights into implications of using various species that growers must consider (i.e., attractiveness of species as hosts for insects that are pathogen vectors) and that can be used as future research topics.

Summarize the project objective the result serves, including expected impact. (1-3 sentences or bullets; Narrative section I.a and II.a.)

The objectives of this project are to: 1) assess how four different legume species, including two annual legumes (subterranean clover, berseem clover) and two perennial white clovers (Ladino white clover, Kakariki white clover), impact soil nutrient cycling and the aboveground growth, nutrient status, and rooting behavior of grapevine, relative to a common perennial fescue under-vine cover crop (creeping red fescue); and 2) evaluate how these different cover crop species impact yield, fruit ripeness and composition (TSS, pH, TA, YAN, and K+ concentration), and rot incidence.

The expected impact of this work is to facilitate the increasing adoption of under-vine cover crops in vineyards by providing recommendations for their optimal uses, depending on stakeholder production goals.

Summarize the project's workplan. (1-5 sentences or bullets; Narrative section III.b.)

A field experiment will be established in 2025 that will continue for 2 consecutive field seasons. Cover crops will be seeded in spring of 2025 and establishment success will be determined by measuring cover crop biomass at grapevine bloom and veraison. Impacts of cover crop treatments on grapevine nutrient status will be determined by collecting vegetative tissues (petioles, leaf blades) at bloom and veraison and submitting them to the PSU Ag. Analytical Services Lab for nutrient analysis. Soil cores will be collected at veraison to determine impacts of cover crops on grapevine root traits important for nutrient absorption, root competition between cover crops and grapevines, and soil nutrient cycling. Soil subsamples from cores will be submitted to the PSU Ag. Analytical Services Lab for quantification of soil phosphorus, potassium, nitrate, and ammonium. Yield parameters will be collected at harvest to determine impacts on yield, and cluster samples will be collected for analysis of important juice composition metrics at harvest (TSS, pH, TA, YAN, and K concentration).

Wintertime assessments of bud freeze tolerance will occur to assess impacts on bud freeze tolerance, in addition to collection of pruning weights to determine impacts to vine vegetative growth. These measurements will be performed annually for two consecutive growing seasons (2025, 2026). Project results will be presented to stakeholders at industry and extension events, via webinars, meetings, workshops, demonstrations, emails, bulletins, and peer-reviewed academic journal articles.

List the indicators that will show the project has a) made progress on its workplan, b) achieved its objective, and c) reached its audience. (1-5 sentences or bullets; Narrative section III.c.)

Project progress and updates will be assessed monthly by the project team (12 meetings in total per year). We aim to present project updates and results to about 250 Virginia stakeholders annually via 1-2 presentations at annual meetings organized by the VVA (Winter and Technical Meetings). We will also reach about 50-100 researchers, consultants, and extension agents annually through 1 presentation at academic conferences, in addition to 300+ readers through 1-2 peer-reviewed research journal articles and 1 Extension-styled publications. During the project and following the project's completion, we will digitally and verbally assess ~50-75 stakeholders on their current use of cover crops in vineyards, if the mixes and species used here are of interest to them (and if they adopt them), and which species they would be interested in planting. We anticipate about a third of respondents indicating a continued desire to plant cover crops.

3.2 Mid-Year Report (December)—Research and Education Grants only

Provide project indicator status information. Describe project/workplan progress. Include any obstacles the project has encountered and the plan to overcome them.

Field experiment was successfully established and project is under way. Suboptimal environmental conditions (unexpected dryness in the late winter and early spring) hindered cover crop establishment following seeding in March 2025; supplemental seeding occurred in October 2025 to improve cover crop stand establishment. Additionally, Persian clover was substituted for berseem

clover, as it was considered a better fit for vineyards following discussions with seed companies. Data collection efforts were successful, and data was collected on vine yield parameters, cover crop establishment, soil water characteristics of interest (i.e., water unsaturated hydraulic conductivity), and soil nutrient concentrations. Analyses of fruit chemical composition (sugar, pH, TA, YAN, K, malic acid, etc.) are under way, and additional data collection will occur during the winter 2026.

Project was featured at VVA's Summer Technical meeting on July 31, 2025, reaching about 80 of the stakeholders; another 40-50 stakeholders were reached via a station-wide Fruit Industry Field Day on September 25, 2025. Project updates were also provided to about 30 attendees at a quarterly meeting of the Loudoun Wineries & Winegrowers Association on August 20, 2025, and to members of the Loudoun Rural Economic Development Council (~15 members present) at a meeting on November 18, 2025.

3.3 Final Report (June)

Compare the project to the objective, workplan, and project indicators. Provide (as a link or attachment) the project deliverable or result. Describe the realized or expected impact of the project.

The first experimental year (2025-2026) is complete for this experiment and this experiment remains in progress, to be continued with continuation funds provided by the Board. Following suboptimal cover crop establishment in 2025, plots were reseeded and successfully established by March 2026. Fall-seeding of cover crops resulted in greater establishment, but one selection (Persian clover) remained difficult to grow and 1 of the 4 replicates required reseeding again in early Spring. Because of this, it appears that Persian clover may require better germination conditions that the experimental plot experienced and/or specific seeding methods would have to be evaluated for optimal establishment. Under-vine cover crops did not appear to affect vine yield parameters measured at harvest in September 2025, fruit ripeness metrics (total soluble sugars, pH, and titratable acidity) assessed on juice of harvested fruit, or vine size, as determined at dormancy by measuring pruning weights, relative to herbicide-maintained control. However, dry conditions in 2025 yielded suboptimal stand establishment by harvest-time. Reseeding in October 2025 resulted in much improved establishment by March 2026, when grapevines began their annual growth cycle.

We installed soil matric potential sensors which can be used to assess plant-available soil water resources. Data collected in 2026 indicated that the two perennial legume selections (Ladino white clover, Kakariki white clover) reduced available water resources at a faster rate than annual legume selections (Persian clover, subterranean clover), a rye-fescue mix, and soil in the herbicide control, suggesting potential implications for vine water uptake and status. These legumes had greater aboveground and belowground biomass, resulting in greater soil water usage, but this usage did not affect vine water status, when measured during the project period in 2025 and 2026. However, Future data collection efforts will continue to assess whether this rapid soil drying under cover crop cultivation affects vine growth and other anatomical traits. Soil samples were also collected from each plot to assess the effects of cover crop on microbial activity, an indicator of soil health. All cover crops led to greater microbial activity, but only the Ladino-type clover statistically increased activity relative to the herbicide control. Based on data collected so far, the perennial white clover-type cover crops appear to be the best value (Kakariki and Ladino white clovers); this conclusion is reached considering stand establishment, competition with weeds, and potential for modifying the soil in a positive way (improving soil microbial activity, adding organic matter, and more).

Finally, multiple spring frost and freeze events occurred in April 2026 that resulted in near-total primary shoot mortality, affecting the potential yield for 2026 and canopy growth. This resulted in an inability to assess potential carryover effects of cover cropping on vine yield formation. Additionally, it was not possible to collect tissue samples at bloom for assessment of vine nutrient status. Future data collection efforts will aim to assess impacts on vine nutrient status, as well as soil nutrient composition, with a particular focus on soil nitrogen pools (nitrate, ammonia) and soil carbon. While efforts to present preliminary results remain forthcoming, including at the 2026 VVA Summer Technical Meeting, we expect that results from this study will help inform cover crop selection and decision-making and increase adoption of under-vine cover crops in Mid-Atlantic vineyards.

4.0 COMMUNICATION WITH STAKEHOLDERS

4.1 PROPOSAL (February)

Identify the specific audience/s for this project. (1-2 sentences or bullets; Narrative section II.b.)

This proposal targets industry stakeholders that are either already using under-vine cover crops or are interested in adopting them in their vineyards within Virginia, the Mid-Atlantic, and elsewhere. A secondary audience includes extension personnel, industry consultants, and other viticultural researchers who are providing guidance on implementation of cover crops in vineyards.

Summarize how you will share project information or results with this audience. For example, will you submit for publication in a peer reviewed journal? Present at a technical conference? Conduct a training? Post on a site?. (1-3 sentences or bullets; Narrative section II.b.)

Project results will be shared with these audiences via presentations and updates given at industry and extension-organized events, including annual conferences (VVA technical meetings), virtual and in-person field days and workshops (1-2), our regular virtual extension programming and webinars (4-6 meetings per year), email listserv communications, and more. Project information will be used to develop 1 Extension bulletins and to submit 1-2 peer-reviewed journal articles in the American Journal of Enology and Viticulture or other viticulture-focused journals. Finally, PI Harner and the graduate student will present project results and updates at 1-2 conferences for viticulture and/or horticulture academic societies. Project details and information will be hosted on the Harner lab website (harnerlab.com).

4.2 Mid-Year Report (December)—Research and Education Grants Only

Describe communication with stakeholders to date. Note dates and locations of events or publications, as available/relevant, and cite or estimate the number reached.

Various outreach efforts have been completed during the reporting period. First, this project was featured at VVA's Summer Technical meeting on July 31, 2025, reaching about 80 stakeholders who had attended the meeting; another 40-50 stakeholders were reached via a station-wide Fruit Industry Field Day on September 25, 2025. Project updates were also provided to about 30 attendees at a quarterly meeting of the Loudoun Wineries & Winegrowers Association on August 20, 2025, and to members of the Loudoun Rural Economic Development Council (~15 members present) at a meeting on November 18, 2025. This project was also featured as part of PI Harner and Dr. Mizuho Nita's Virtual Vineyard Meetings, which take place monthly from April-October and reach between 20-30 participants during each meeting.

4.3 Final Report (June)

Describe how the technical or material content of the project was or is planned to be shared with stakeholders or beneficiaries, and cite or estimate the number reached. List title, date, type (article,

brochure, presentation, or other), purpose, and estimated audience reached. Provide a copy or link if (when) available for inclusion on the virginiawine.org site.

Preliminary data from this experiment was presented in June 2026 at the VVA's Summer Technical Meeting to about 100 attendees, as part of a full-day program on vineyard groundcover management. Slides from this meeting will be uploaded to PI Harner's Extension program website (<https://vtviticulture.com/project-data-and-resources/>), including a blog post with updates and discussion of the data by the graduate student who is currently working on this project. Second, results from this study will be presented in fall 2026 at the joint annual meeting of the Soil Science Society of America, Agronomy Society of America, and Crop Science Society of America, in Portland, Oregon. Selected data from this experiment will also be published in a peer-reviewed journal in 2027, with a target of *Plant and Soil*. Once published, a copy of the manuscript will be stored on PI Harner's lab website (<https://harnerlab.com/publications/>) for public access.

We have not yet conducted a survey or poll of stakeholder interest in and current implementation of cover cropping, as was planned. This activity is slated to occur within the next calendar year, potentially with industry personnel.

5.0 BUDGET

Budget Summary			Mid-Year Research/Education only		Final	
Expense Category	5.1 Request	5.2 Awarded	5.3 Spent	5.4 Remaining	5.5 Spent	5.6 Remaining
Personnel	\$25953	25953	13730.98	12222.02	22225.48	3727.52
Fringe Benefits	\$2695	2695	1120.53	1574.47	2065.98	629.02
Contractual	\$3850	3850	1851.31	1998.69	1851.31	1998.69
Travel	\$1500	1500	290.10	1209.90	290.1	1209.90
Supplies	\$2000	2000	1053.75	946.25	1053.75	946.25
Equipment (Rental)	\$0	0	0	0	0	0
Other	\$8640	8640	8549	91	17098	-8458
Total	\$44638	44638	26505.67	18042.33	44584.62	53.38