

**Title of Report: RENEWAL PROGRESS REPORT FOR CDFA AGREEMENT NUMBER 16-0616-SA (SPO AWARD #201602418)**

**Title of Project:** Education and Outreach for the Grapevine Certification and Registration Program, and an Assessment of Recently Established Production Vines from Increase Blocks.

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**REPORTING PERIOD:** The results reported here are from work conducted January 2017 to January 2018

**Introduction:**

Certified grapevine nursery stock consumers (grape producers) are concerned that the quality of the product they are purchasing from the clean plant program does not meet the standard they believe it should. Much of this concern stems from the expectation that certification offers something greater, in terms of freedom from virus contamination, than it scientifically can. With the discovery that Grapevine Leafroll-associated virus 3 (GLRaV-3) is spreading in California, in addition to the discovery of *Grapevine red blotch virus* (GRBV) (Al Rwahnih et al. 2013; Golino et al. 2008), grape producers question the quality of certified vines. There is good evidence that clean plant programs work and that they have large economic benefits that can be shared by all actors in the supply chain (Fuller *et al.*, 2015), but, as with all supply chains, in order for clean plant programs to work well, they require mutual trust between the actors in the chain. By defining the term “*certified*” according to the scientific sampling procedure and educating growers of the meaning of this term, we can bridge the current gap in perceptions that exists between the clean plant system and the purchasers of its products. However, because some viruses can be spread by vectors, unless a complete census of all certified vines was carried out every year, it is impossible for any certification program to reduce virus incidence to zero. The meaning of the term “certified” must be defined in relation to the statistical performance of the actual sampling plan used. In order for grower trust in the system to build, that meaning must be clearly articulated and appropriate expectations established for disease incidence in planting material emerging from a program using the definition. Additionally, it is unclear at this time what level of background infection per year occurs in nursery increase blocks as well as a lack of understanding of potential reinfection of increase blocks between sampling rotations. The intentions of this project are to provide quantifiable outreach and extension involving the certification program while addressing the background infection in nursery increase blocks and the potential reinfection in increase blocks between sampling bouts.

**Objectives:**

- A. To develop a grower information pack and slide presentation to summarize the Grape Certification and Registration Program
- B. Hold grower meetings in key grape-growing regions of California to explain the functioning and efficacy and limitations of the certification program
- C. To quantify the impact of education and outreach by issuing pre-test and post-test surveys at grower meetings
- D. To assess the level of potential contamination or reinfection in newly established vineyard blocks when material is sourced from increase blocks
- E. To assess the level of reinfection of leafroll-3 and Red Blotch viruses in increase blocks between certification sampling bouts

**Activities:**

- A. To develop a grower information pack and slide presentation to summarize the Grape Certification and Registration Program
  - a. Multiple slide presentations have been produced and presented in numerous parts of the state, including Bakersfield, Fresno, Salinas, Paso Robles, Tulare, Lodi, San Diego, Davis and Calaveras, CA.
  - b. Since September, a new postdoctoral scholar cooperator, Kamyar Aram, has prepared to continue developing and presenting outreach material. This preparation has included attending extension meetings on grapevine health in Monterey and Kern counties, as well as at UC Davis, and visiting several grapevine nurseries, representing the industry's diversity in enterprise scale, in order to better understand and represent the role of nurseries in outreach about the certified grapevine program.
- B. Hold grower meetings in key grape-growing regions of California to explain the functioning and efficacy and limitations of the certification program
  - a. Work group meetings were held in Bakersfield, Fresno, Mendocino, Carneros and Calaveras.
  - b. Kamyar has made field visits to growers in Fresno, Kern, El Dorado, Placer and Santa Clara counties and connected with viticulture advisors in exploration/anticipation of further engagement with growers and grower support professionals for outreach meetings.
- C. To quantify the impact of education and outreach by issuing pre-test and post-test surveys at grower meetings
  - a. While discussing collaborative projects with Lynn Wunderlich, the farm advisor for Central Sierra Cooperative Extension, Lynn mentioned previous education and outreach presentations provided by Katherine Webb-Martinez, the current Associate Director of Program Planning and Evaluation in the UC Division of Agriculture and Natural Resources. Lynn and Kari contacted Katherine for more information on quantifying the impact of education and outreach. Her advice provided us the opportunity to more appropriately plan to assess impacts by way of a combination of retrospective pre-tests and post-tests. We are currently guiding our questions for the survey in that direction.
  - b. Kamyar is continuing the development of the survey.
- D. To assess the level of potential contamination or reinfection in newly established vineyard blocks when material is sourced from increase blocks.

Samples were collected from vineyards established with certified planting stock in the last 1–3 years in diverse viticultural areas in the state, including in Napa (Carneros), Sonoma, Mendocino, San Joaquin (Lodi), Kern, Fresno, Calaveras, El Dorado and Placer counties. The samples have been analyzed for 7 graft-transmissible grapevine viruses by total nucleic acid extraction and qPCR. In addition to testing for the most important agents of grapevine virus disease in California, namely GLRaV-3 and GRBV, samples were tested for GLRaVs -1, -2, and -4 and Grapevine Vitiviruses Grapevine viruses A (GVA) and B (GVB). Quantitative analysis of this data as well as some additional virus testing is planned.
- E. To assess the level of reinfection of leafroll-3 and Red Blotch viruses in increase blocks between certification sampling bouts.
  - a. Joshua Kress at the CDFA has been contacted in order to access the diagnostic information when it becomes available.

**Publications produced and pending, and presentations made that relate to the funded project.****Publications:**

- Arnold, K. L., Golino, D., & McRoberts, N. (2016). A synoptic analysis of the temporal and spatial aspects of grapevine leafroll disease in an historic Napa vineyard and experimental vine blocks. *Phytopathology*. <http://dx.doi.org/10.1094/PHYTO-06-16-0235-R>

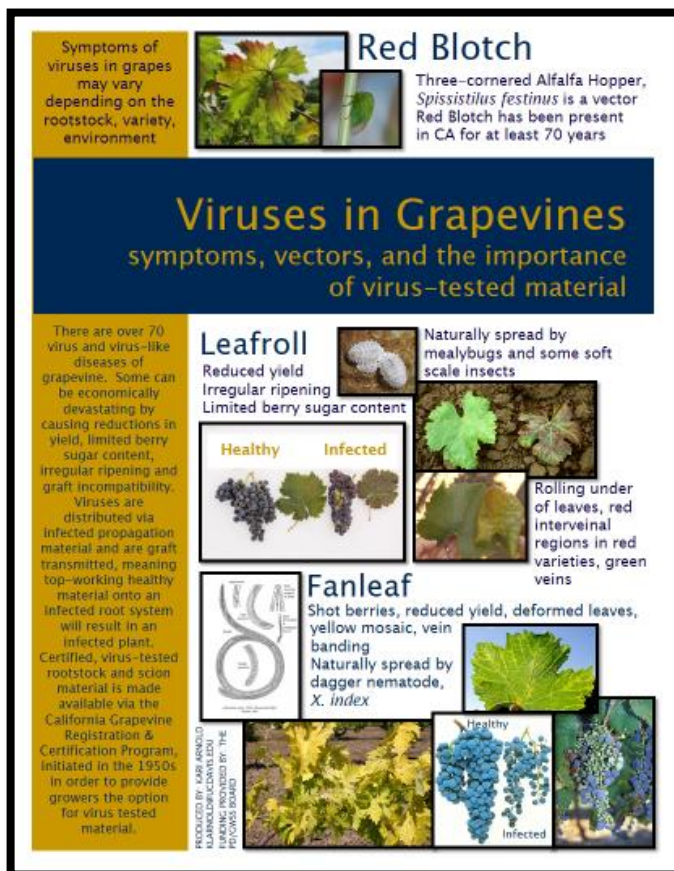
- Arnold, K.L., McRoberts, N. and Golino, D.A. (In press.) North coast virus survey reveals improving health of vineyards over decades. California Agriculture.

#### Presentations:

- “Virus Workshop”
  - Utilized as a backbone to the workshop discussions for both the Bakersfield and Fresno groups on May 16<sup>th</sup> and 17<sup>th</sup>. Both meetings were well attended and discussion ensued ranging from basic information to in depth management decisions. Attendees expressed their appreciation for the direction and atmosphere provided.
- “Working with Work Groups”
  - Presented at the Red Leaf Disease Research Review Board meeting for PD/GWSS funding in Davis, CA
- Field visits have been provided to growers in Mendocino, Calaveras, Carneros and Lodi.
- “Grapevine Certification: viruses in grapevines”
  - Presented at the Calaveras Winegrape Alliance educational meeting in Murphys, CA
  - Attended Vineyard Tour in Calaveras in order to answer questions involving certification

#### Handout:

- “Viruses in Grapevines”
  - Provided at field days in Mendocino, Calaveras, and Carneros. See the following:



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**UC Integrated Viticulture** For more information on virus diseases, please visit the UC Integrated Viticulture website at:  
[http://iv.ucdavis.edu/Viticultural\\_Information/?uid=121&ds=351](http://iv.ucdavis.edu/Viticultural_Information/?uid=121&ds=351)

**Online Resources**  
 for mealybugs, foundation plant services,  
 certification and viruses

Mealybugs and some scale insects can spread leafroll. Integrated pest management strategies are effective against mealybugs, but rogueing infected vines and re-establishing old, infected blocks will reduce inoculum which limits future spread of the virus. For more on mealybugs, follow these urls→

**Foundation Plant Services & the California Grapevine Registration & Certification (CGR&C) Program**

FPS produces, tests, maintains and distributes elite, disease-tested plant propagation material. They provide plant importation and quarantine services, virus testing, virus elimination and the coordinated release of UC-patented varieties.

The CGR&C Program is voluntary and provides diagnostic testing of source vines for significant grape virus pathogens

For more information:  
<http://fps.ucdavis.edu/fgrcdfa.cfm>  
<https://www.cdfa.ca.gov/plant/pe/nsc/nursery/grapevine.html>  
[https://www.cdfa.ca.gov/plant/pe/nsc/docs/regs/ccr\\_3024\\_grapevine.pdf](https://www.cdfa.ca.gov/plant/pe/nsc/docs/regs/ccr_3024_grapevine.pdf)

[http://cenapa.ucanr.edu/Napa\\_County\\_Programs/Viticulture/Vine\\_Mealybug/](http://cenapa.ucanr.edu/Napa_County_Programs/Viticulture/Vine_Mealybug/)  
[http://cesonoma.ucanr.edu/Integrated\\_Pest\\_Management685/Mealybugs/](http://cesonoma.ucanr.edu/Integrated_Pest_Management685/Mealybugs/)  
<http://cekern.ucanr.edu/?facultyid=955>  
<http://ucanr.edu/?facultyid=481>

### Research Relevance:

Grapevine viruses and other internal pathogens have been related to vineyard problems long before we ever knew they were there. Many issues troubling growers in the 1930s were later attributed to Pierce's Disease, fanleaf and leafroll (Bioletti 1931; Matthews 2012). Likely due to the immediate destructive nature of Pierce's Disease as well as extensive outreach programs, growers in citrus and grapes combined their efforts to facilitate regional control of the vectors spreading the disease and the pathogen responsible for the disease decades ago. This type of effort has only recently been supported by industry for virus related issues like leafroll. For many years viruses were perceived by growers as non-problematic. This false perception is likely attributed to the fact that many vineyards were previously established on rootstocks like AXR#1 and St. George (Wolpert et al. 1994), both of which are associated to the reduction of virus symptom expression (Golino 1993). After the failure of AXR#1, alternative rootstocks with varying levels of disease tolerance were grafted onto infected budwood from existing fields which led to many virus related issues. It has taken decades since this turn in material to help growers understand the problems associated to certain viruses in vineyards in part due to the fact that virus symptoms are variable depending upon the season and different viruses cause different symptoms. Additionally, leafroll, a virus which reduces yield and limits sugar accumulation in the berry, easily spread from one vineyard block to the next via its primary vector, common mealybug species. Decades after the failure of AXR#1, a pilot workgroup began in Napa with the intentions of managing leafroll regionally due to the rigorous efforts of our team (those mentioned in the heading as well as Monica Cooper, the Farm Advisor of Napa County). After five years of monthly meetings where growers shared the challenges and successes of their endeavors, growers in Napa feel they have leafroll under control. With the consistent extension and outreach explaining these work groups, growers across California have grown interested in replicating these efforts in their region. The overall intention of this project is to provide this opportunity to all grape/wine grape growing regions in California so that in the future, our investment in certified, virus tested material does not end at establishment. Additionally virus survey work will be completed in order to update protocols performed by the program.



**Layperson Summary of Project Accomplishments:**

Since project initiation in October of 2016, the principal investigator and cooperators have collaborated with farm advisors and industry related personnel across California to inform grape growers and viticulture support professionals about the impact of grapevine virus diseases and strategies for managing them. These activities included meetings and presentations accessible to growers in most major California grape-growing regions, including the Sierra foothills, Bakersfield, Fresno, Paso Robles, Tulare, Lodi, San Diego and Davis, CA. Work group meetings or field days have also been provided or supported in Bakersfield, Fresno, Lodi, Mendocino and Carneros. Additionally we participated in the Calaveras Wine Alliance Vineyard Tour in order to spread the word about education, outreach and vineyard sampling provided by this program. Collaboration with San Luis Obispo county viticulture advisor, Mark Battany, is planned for outreach in the Central Coast. These efforts increase awareness of these important but often neglected diseases and highlight the importance of using certified planting stock along with vector management and removal of infected vines to limit disease impact on production. They also emphasize the need for regional cooperation to prevent spread from infected to new or unaffected vineyards as a long-term strategy to reduce the cost of virus diseases to the industry as a whole. Finally, in order to discuss realistic expectations of certified stock, we need to evaluate the rate of virus occurrence in vineyards recently planted with certified stock. To this end, vineyards established from certified stock in the last three years have been sampled throughout many of the state's grape-growing regions and analyzed for infections by important grapevine viruses, including those causing leafroll and red blotch disease, which are the most important grapevine diseases caused by viruses. The analysis of this data is underway. Further data about the rate of virus infection found in certification increase blocks by the CDFA for the Grapevine Certification and Registration program is expected and will be analyzed in combination with our own data to evaluate the risk level of virus infection in certified stock.

**Status of Funds:**

Spending is appropriated to the project and on track with intentions of the grant. Remaining funds are sufficient for project continuation and completion.

**Status of Intellectual Property:**

There is no intellectual property associated to this project.

**Literature cited:**

Al Rwahnih, M., Dave, A., Anderson, M.M., Rowhani, A., Uyemoto, J.K., Sudarshana, M.R., 2013. Association of a DNA virus with grapevines affected by red blotch disease in California. *Phytopathology* 103, 1069–1076.

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Wolpert, J., Walker, A., Weber, E., Bettiga, L., Smith, R., Verdegaaal, P., 1994. Rootstocks and phylloxera: A status report for coastal and northern California. *Viticulture Notes* 6, 1–17.

Please submit the report online at <http://www.piercesdisease.org/>. Click on “Researcher Login” and follow the instructions. Questions about the website or uploading your report can be emailed to [questions@piercesdisease.org](mailto:questions@piercesdisease.org)

