Pennsylvania Wine Market & Research Promotion Program

Progress Report

A financial status report and a project performance report will be required on a semi-annual basis. October and April reports are due. A final report may serve as the last semi-annual report due 30 days after completion of the contract. Grantees shall monitor performance to ensure that time schedules are being met and projected goals by time periods are being accomplished. Please submit reports to: RA-AGCommodities@pa.gov.

SECTION 1 – SUMMARY INFORMATION

Date of Report:	January 6, 2020
Title of Paper:	Does delaying budburst reduce the risk of frost damage while maintaining grape and wine quality? Comparing the effectiveness of pruning time and Amigo application
Contract/PO#:	63018277 Fiscal Year: 2019/2020 Round of Grant: (i.e. Round 1, Round 2, etc) 3
Organization:	The Pennsylvania State University
Project Coordinator:	Michela Centinari, Assistant Professor of Viticulture
Organization Address:	110 Technology Center
City/State/Zip:	University Park, PA 16802-7000
Business Phone:	814-867-0514 Cell Phone: N/A
Email:	mzc22@psu.edu
Progress Report:	☐ Interim ☒ Final
Area of Focus:	☒ Research ☐ Marketing

SECTION 2 –OBJECTIVES | TIMELINES | OUTCOMES | BUDGET

(A comparison of actual accomplishments to the objectives for that period?)

Our long-term goal is to provide Pennsylvania grape growers and wine producers with recommendations and best practices to decrease the risk of freeze damage and subsequent crop losses while maintaining wine quality. Two frost avoidance strategies have been investigated beginning in 2017: (a) application of a food grade vegetable oil-based adjuvant (Amigo®), a mixture of 93% oil (active ingredient) and 7% emulsifier; and (b) delayed winter pruning until after budburst. The specific **objectives** for this reporting period were to **1:** Compare the effectiveness of delayedwinter pruning and Amigo (8% and 10% v/v) on delaying budburst, without negatively impacting grape production and finished wine quality and sensory perception in both red and white grapevine varieties; **2:** Assess the impact of Amigo and delayed winter pruning on cold acclimation of primary buds.

Timeline: July 2019 to December 2019.

Objective 1. During the summer of 2019, we collected field measurements to assess the impact of treatments on vine phenology, production, and fruit ripeness (note: the treatments were imposed in spring 2019, prior to the reporting period). Vines were harvested on September 30 (Riesling) and October 4, 2019 (Lemberger). Wines were made for both varieties, for a total of 12 fermentations for the Lemberger and 8 fermentations for the Riesling. In December 2019, wines were analyzed for basic chemical analysis (residual sugar, alcohol, volatile acidity, free and total sulfur, titratable acidity, pH, lactic acid, and malate) before bottling to ensure stability in bottle. In spring 2020, Lemberger and Riesling wines will be screened for differences through awine sensory discrimination test (as part of round of grant 4). Wine samples from each treatment will be analyzed using Gas Chromatography Mass Spectrometry (GC-MS) to separate and identify flavor and aromatic compounds (as part of round of grant 4).

Objective 2. Canes were collected to determine bud freeze tolerance duringvine acclimation (November 2019), Bud freeze tolerance was measured using Differential Thermal Analysis (DTA). Tissue samples was collected from roots, trunks, and canes to quantify non-structural carbohydrates (starch and soluble sugars) during acclimation (November 2019).

Outcomes:

- Treatments successfully delayed grapevine budburst in 2019. Delayed pruning was more effective than Amigo in delaying budburst: delayed-pruned vines reached 50% budburst 12 days later than control vines for both varieties. A frost event occurred at the experimental site on April 29, 2019, when Lemberger vines were close to budburst. In Riesling, control vines were about two weeks from budburst at the time of the frost; therefore, damage was minimal.
- Delayed-pruned Lemberger vines had significantly less freeze damage to shoots than control vines, which resulted in higher crop yield at harvest (3.93 tons/acre versus 2.44 tons/acre; **Table 1**). There were no differences in juice and wine chemistry between wines made with control and treated Lemeberger grapes (**Table 2 and 3**).
- Delayed-pruned Riesling vines had significantly lower cluster and berry weight than control vines, which resulted in 33% lower crop yield (**Table 1 and 2**).

- In both varieties, Amigo and delayed-pruned vines had similar bud freeze tolerance than control vines in November 2019. Therefore, delaying budburst did not negatively affect vineability to acclimate to cold temperatures. Measurements will be repeated in January/ February 2020 to assess effects of treatments on maximum cold hardiness (as part of round of grant 4).

Overall, data collected so far indicate that delay winter pruning was effective in decreasing spring frost damage and reducing consequent crop losses at harvest without negatively affecting juice and wine chemistry and cold hardiness. However, delay winter pruning might not be a practice suitable for all grape varieties, as it reduced yield capacity in Riesling.

Budget: Financial reporting is provided by the Department of Research Accounting at PSU in accordance with the terms of the grant agreement.

SECTION 3 – SCOPE OF WORK

(Reasons why established objectives were not met, if applicable?)

N/A

SECTION 4 – DELAYS/RISKS

(Reasons for any problems, delays, or adverse conditions which will affect attainment of overall program objectives, prevent meeting time schedules or objectives, or preclude the attainment of particular objectives during established time periods. This disclosure shall be accomplished by a statement of the action taken or planned to resolve the situation?)

N/A

SECTION 5 – SPECIAL NOTES

(What objectives and timetables are established for the next reporting period? Etc.)

This is a final report

Table1. Treatment effects on Lemberger and Riesling yield parameters at harvest. Treatments abbreviation: C = control (no frost avoidance practice applied); A8 = Amigo oil™ applied at 8% (v/v) concentration during the dormant season; A10 = Amigo applied at 10% (v/v) concentration during the dormant season; DP = delayed winter pruning until after budburst.

Treatment	Yield (kg/vine)	Yield (tons/acre)	Cluster wt (grams)	Clusters/ vine	Berries/ cluster
Lemberger					
C	2.03 b[z]	2.44 b[z]	138.8	14.9 b	77
A8	3.02 ab	3.63 ab	156.5	19.2 ab	84
A10	2.72 ab	3.27 ab	153.5	17.4 ab	90
DP	**3.27 a**	**3.93 a**	151.2	21.0 a	87
P-value	0.045		0.404	0.094	0.344
Riesling					
C	1.12	1.34	78.6 a	13	39 ab
A8	1.27	1.52	86.9 a	15	46 ab
A10	1.51	1.81	94.5 a	16	52 a
DP	0.75	0.90	**51.7 b**	12	33 b
P-value	0.171	0.171	0.003	0.645	0.023

[z]Means within columns followed by different letters are significantly different based on Tukey Kramer ($P < 0.1$).

Table 2. Treatment effects on Lemberger and Riesling fruit composition at harvest. Treatments abbreviation: C = control (no frost avoidance practice applied); A8 = Amigo oil™ applied at 8% (v/v); A10 = Amigo applied at 10% (v/v); DP = delayed winter pruning until after budburst.

Treatment	TSS (°Brix)	pH	TA (g/L)	Berry Weight (grams)
Lemberger				
C	23.50	3.56	6.62	1.83
A8	22.30	3.50	6.44	1.86
A10	22.47	3.54	6.66	1.72
DP	23.50	3.54	6.38	1.72
P-value	0.192	0.516	0.361	0.379
Riesling				
C	18.57	3.46 ab[z]	7.49	2.06 a
A8	18.90	3.43 b	7.74	1.88 ab
A10	18.53	3.54 a	7.69	1.86 ab
LP	17.90	3.36 b	8.40	**1.60 b**
P-value	0.496	0.006	0.176	0.010

[z]Means within columns followed by different letters are significantly different based on Tukey Kramer ($P < 0.05$).

Table 3. Basic wine chemistry parameters prior to bottling for Lemberger. Treatments abbreviation: C = control (no frost avoidance practice applied); A8 = Amigo oil™ applied at 8% (v/v); A10 = Amigo applied at 10% (v/v); DP = delayed winter pruning until after budburst.

Treatment	EtOH (%)	RS (g/L)	pH	Total acid (g/L)	Malic acid (g/L)	Lactic acid (g/L)	Volatile acidity (g/L)
C	12.6	1.1	3.8	5.5	0.2	2.2	0.49
A8	12.5	1.1	3.8	5.6	0.1	2.3	0.50
A10	12.5	1.0	3.8	5.6	0.1	2.2	0.50
DP	12.7	0.9	3.8	5.5	0.0	2.0	0.49
P-value	0.763	0.239	0.427	0.902	0.233	0.422	0.870