Index No.: AGR010
Contract No.: CSP900113
Eff. Date: 07/01/16

STATE OF OHIO
DEPARTMENT OF ADMINISTRATIVE SERVICES
GENERAL SERVICES DIVISION
OFFICE OF PROCUREMENT SERVICES
4200 SURFACE ROAD, COLUMBUS, OH 43228-1395

AMENDMENT FOR CHANGE
AMENDMENT NO. 10

TO: LIMITED DISTRIBUTION - OHIO DEPARTMENT OF AGRICULTURE

FROM: ROBERT BLAIR, DIRECTOR, DEPARTMENT OF ADMINISTRATIVE SERVICES

SUBJECT: CONTRACT FOR OHIO GRAPE INDUSTRIES EXTENSION AND RESEARCH PROGRAM

Attached are pages 1 and 17 through 31 to this contract. Remove these pages from the existing contract and replace with the attached pages on the effective and/or revision date.

As a result of mutual agreement between the State of Ohio and the contractor, this amendment is issued to renew the subject contract an additional twelve (12) months, effective July 1, 2016 through June 30, 2017.

Projects approved for FY16 were added, the Cost Summary was updated, Administrative Contact was updated and the document was re-paginated.

All other prices, terms and conditions remain unchanged.

This Amendment, the Contract and any additional Amendments thereto are available from the DAS Web site at the following address:

http://www.ohio.gov/procure

Affected Contractor(s):

678 (address 48)
The Ohio State University
Office of Sponsored Programs
1960 Kenny Road
Columbus, OH 43210-1063
dami.1@osu.edu
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STATE OF OHIO
DEPARTMENT OF ADMINISTRATIVE SERVICES
GENERAL SERVICES DIVISION
OFFICE OF PROCUREMENT SERVICES
4200 SURFACE ROAD, COLUMBUS, OH 43228-1395

MANDATORY USE CONTRACT FOR: OHIO GRAPE INDUSTRIES EXTENSION AND RESEARCH PROGRAM

CONTRACT NUMBER: CSP900113

EFFECTIVE DATES: 07/01/12 TO 07/31/14
* Renewal through 06/30/17

The Department of Administrative Services has accepted Proposals submitted in response to Request for Proposal (RFP) No. CSP900113 that opened on March 2, 2012. The evaluation of the Proposal responses has been completed. The Offeror listed herein has been determined to be the highest ranking Offeror and has been awarded a Contract for the services listed. The respective Proposal response including, Contract Terms & Conditions, any Proposal amendment, special Contract Terms & Conditions, specifications, pricing schedules and any attachments incorporated by reference and accepted by DAS become a part of this Services Contract.

This Requirements Contract is effective beginning and ending on the dates noted above unless, prior to the expiration date, the Contract is renewed, terminated, or cancelled in accordance with the Contract Terms and Conditions.

This Requirements Contract is available to the Ohio Department of Agriculture as applicable.

The agency is eligible to make purchases of the contracted services in any amount and at any time as determined by the agency. The State makes no representation or guarantee that department will purchase the volume of services as advertised in the Request for Proposal.

This Requirements Contract and any Amendments thereto are available from the DAS Web site at the following address:

http://www.ohio.gov/procure

*Indicates renewal effective 07/01/16.

MUTUALLY AGREED-UPON PROJECTS FOR FY16 (continued)

PRODUCTION

1. Commercial Expansion of Varieties New to Ohio. In order to promote varieties tested at OSU research vineyards, maximize their exposure to growers and wine makers, and encourage their expansion, the Viticulture Program in partnership with OGIC started a new variety expansion initiative through a cost-share program in 2014. Six collaborating vineyards and wineries from the main grape growing regions (northeast, northwest, central, southeast, and southwest) in Ohio have participated in the first year of this project. Four hybrid and vinifera varieties (Aromella, Malvasia, Sauvignon blanc, and Teroldego) and an advanced selection (NY81) are purchased and will be planted this spring by cooperating growers and vintners. Due to shortage of plant materials from nurseries, many varieties were not available. Furthermore, vines were more expensive than originally budgeted. If it were not for multiple requests (begging!) by Dami for donations, it would not have been possible to order 5 varieties (750 vines ordered). The actual cost was more than double (~$4,000) the amount requested ($1,500). Dami proposes to continue this project for FY16 with the following adjustment: 1) increase the minimum number of vines per variety provided to cooperators. Many requested 100+vines instead of the minimum 25-50; 2) increase the requested budget due to vine expenses (grafted and rootstocks) and shipping cost; 3) request to purchase a grafting machine to be able to graft specific varieties and clones that are not available from the nurseries. For example, most varieties of interest (e.g. Gamay noir, Siegerrebe, Arneis) were not available in nurseries. Further, some growers suggested varieties to plant in OSU research vineyards that are not available in the nurseries. Thus having the flexibility to graft our own varieties will be highly desired.

*MUTUALLY AGREED-UPON PROJECTS FOR FY17

EXTENSION

1. Winegrape Extension Team Activities. The team will continue to provide extension deliverables to the Ohio grape and wine industry. The “core” program deliverables include:
   A. Ohio Grape & Wine Conference
   B. Grape School, Grape Field Day, and viticulture workshops with relevant topics
   C. Technical information on the Team website, Buckeye Appellation and newsletter, OGEN.

   Additional Extension and Outreach Activities
   A. Fact sheets on new varieties that are recommended by the Viticulture-Enology Program.
   B. Fact sheet on managing winter damaged vines that includes a summary of the 2-year findings from several trials and observations following the 2014 and 2015 winter events.
   C. Midwest Grape Production Guide. Currently under major revision with ten new chapters to be added.
   D. Program Website. Maintain and update. Fruit maturity monitoring will resume in 2016.

2. Viticulture Outreach Activities
   A. Continue on-site visits with a maximum number of 75 visits for the year.
   B. Produce a minimum of 12 issues of OGEN
   C. Continue to update The Grape Exchange as needed by the industry to help facilitate the exchange of equipment, real estate, grape and wine products.
   D. Design and present workshops to deliver best cultural practices.

3. OSU South Centers Activities. Comprehensive training of new and existing grape growers is of vital importance to the success of winegrape growing in southern Ohio and beyond. Testing of cold hardy grape cultivars for premium wine production, development and demonstration of effective vineyard management practices and improvement of basic understanding of grape and wine quality are also critical to a growing wine grape industry. OSU South Centers is uniquely positioned to conduct both basic and applied research on wine grape production and deliver a comprehensive grape grower outreach program.

   Deliverables
   A. Reach at least 50 growers through site visits, workshops and field days or field nights.
   B. Add one small vineyard right next to the existing vineyard.
   C. Keep refining sampling time for more accurate monitoring of nutrient status.
   D. Gain a better understanding of the effects of cultural practices on photosynthesis, fruit color, and other quality parameters.

4. Enology Extension Activities
   A. Participation and Involvement in National and International Meetings
   B. Assist in coordinating the 2017 Ohio Grape and Wine Conference
   C. Continued participation in the Ohio Quality Wine program
   D. Present Post Fermentation Wine Quality Control Workshops
   E. Provide one or two additional workshops on topics of interest

*Indicates addition of FY17 projects effective 07/01/16.

*MUTUALLY AGREED-UPON PROJECTS FOR FY17 (continued)

F. Present research and extension information at the AARS Field Day and Northeast Ohio Grape Twilight Tour
G. Ohio Commercial Tour of the Michigan Grape and Wine Industry
H. Participate in both National and International Wine Competitions
I. Develop Winemaking 101 Best Practices Fact Sheet / Manuscript
J. Researching a Potential Wine Makers Certification Program
K. On-Site Winery Consultations
L. Off-Site Winery Consultations
M. Provide Chemical Analysis of Commercial Wines

RESEARCH

VITICULTURE

1. Managing Grapevines after Successive Winter Injuries. The viticulture group conducted trials at research and commercial vineyards to address issues associated with managing grapevines after winter injury due to extreme low temperatures (-4 to -24oF) in 2014. Unfortunately, in February 2015, sub-freezing temperatures (-5 to -33oF) occurred again in vineyards across Ohio and reached critical levels that were damaging to several grape varieties, especially in Vitis vinifera. The successive damaging winters were exceptional weather events that grape growers never faced before and thus created unique challenges. Due to back-to-back winter damage, we are not able to conclude how recover (yield) in 2016 vines after the winter damage in 2015. Grapevines require two growing seasons (16 months) to complete a yield cycle. It is the purpose of this proposal to complete the project on managing vines after winter damage with a primary focus on evaluating vine recovery and return to normal vine training and crop production, by accomplishing the following objectives:

   A. Develop and evaluate training systems for winter-damaged grapevines
   B. Evaluate best sucker management for trunk renewal
   C. Develop post-damage management practices for commercial vineyards
   D. Disseminate findings of managing grapevines after winter damage.

   The outcome of this study is very valuable to growers as they will be able to select the best vine recovery options for their vineyards based on our findings and recommendations. In the past two years, Dami and his group shared major findings with growers at educational events and via written and electronic publications posted on Buckeye Appellation website (ohiograpeweb.cfaes.ohio-state.edu).

2. Evaluation of Performance and Cultural Practices of Promising Winegrape Varieties. Grape variety evaluation remains a high research priority as indicated by grape and wine producers and supported by OGIC. The OSU Viticulture-Enology Program has evaluated more than 40 varieties in the past 10 years and provided recommendations on successful and widely planted varieties to date including, Pinot gris, Chambourcin, Traminette, Aromella, Noiret, Marquette, LaCrescent, and Frontenac to list a few. Due to severe winter damage to OSU variety trials (70% vine loss in Wooster and 20% in Kingsville), Dami proposes to continue the trial in Kingsville by replacing dead/missing vines. Due to extensive vine loss at the Wooster site, all vines were removed except for one row. Dami proposes to initiate new trials at the Wooster site with the most promising varieties (4 to 6) by planting a larger number of vines per variety to conduct research on best practices to grow these varieties in Ohio. For example, Regent is recommended and now grown commercially, but growers do not have information on the best vineyard practices to grow it (e.g. optimum crop load, optimum fruit maturity). Additionally, we plan to continue testing new varieties and clones but at smaller scale (6-8 varieties instead of 20+). The establishment of these trials will be the first major research planting at OSU since 2008. Therefore, the majority of the viticulture group time and effort will be dedicated toward this project. Further, since this project is tied to the “Variety Expansion Program”, Dami and his group will keep supplying vines, as needed, to cooperating growers-vintners in 2016.

   Methods:
   A. In fall 2015, we ordered vines from nurseries for planting in the spring of 2016.
   B. When not available, specific varieties were ordered as cuttings to graft in our lab. We purchased a grafting machine and grafted vines in March 2016.
   C. We have ordered varieties with potentially high quality wines and different cold hardiness. Advanced selections (not named yet) will also be provided by research breeders: Dr. Bruce Reish at Cornell University, Dr. Matt Clark at the University of Minnesota, and a private breeder, Mr. Tom Plocher.
   D. In spring 2016, we will replant the variety block in Wooster and replace dead and missing vines and varieties that underperformed in Kingsville.
   E. Since not all vines will be ready this spring (newly grafted in 2016), we will continue planting during the spring of 2017 as well.
   F. Grafting will continue in 2017 to produce missing vines for both the evaluation trial and variety expansion. Grafting will become an integral part of our research, as we need vines on a yearly basis.
   G. In addition to planting and training the newly planted vines in research vineyards in Wooster and Kingsville, Dami’s group will maintain hundreds of potted vines grafted this year in the greenhouses.

*Indicates addition of FY17 projects effective 07/01/16.

*MUTUALLY AGREED-UPON PROJECTS FOR FY17 (continued)

PLANT PATHOLOGY

1. Statewide Distribution of Grapevine Viruses. Viruses are important pathogens of grapevines that are known to cause decline in vineyard productivities. Thanks to the generous support by OGIC during the last two years, we have visited a total of 28 vineyards spanning all six Ohio wine production regions, collecting a total of 162 grapevine leaf samples. We then extracted RNA from each of the 162 samples, pooled the RNA into one RNA pool, and subjected the pooled RNA to high throughput sequencing (RNA-Seq) to identify all possible viruses in the collected samples. Analysis of RNA-seq data indicated that at least 21 different viruses are present in Ohio vineyards (Table 1). Sequence signatures for at least one new virus are also present in the dataset. It now becomes critical to map these viruses back to their respective field locations so that the scope and prevalence of each of the viruses can be further assessed.

   Expected measurable outcomes:
   A. We will obtain the detailed, location-specific information about all 21 viruses listed in Table 1 of OSU FY17 Proposal.

   B. This information is expected to permit improved control and management of existing virus problems, as well as to facilitate the development of effective standard operation procedures aimed at preventing future introduction of new viral pathogens.

   C. The knowledge gathered, in combination with the newly established management procedures, will be broadly disseminated to the stakeholders, leading to increased awareness of the damages that can be caused by these pathogens.

2. Maintaining a Successful Integrated Disease Management Program for Ohio Grape Growers. Commercial production of grapes in the Midwestern United States utilizes Integrated Pest Management (IPM) programs to protect the crop from injuries due to plant diseases. Successful management of grape diseases requires management actions throughout the growing season. Combining resistance with good cultural practices and an array of pesticides has enabled growers to produce a profitable crop while simultaneously controlling many grape diseases in Ohio. All the research and extension studies in this proposal focus on maintaining and improving upon current IPM recommendations for grape growers in Ohio. It is our intention to build and expand on the breadth of research previously conducted by the Fruit Pathology Program at Ohio State University.

   Diseases continue to be one of the major factors limiting grape production in Ohio. Many of the commercial varieties favored by Ohio grape growers are susceptible to many diseases including downy mildew, black rot, and Botrytis bunch rot. We will continue to evaluate experimental and currently available fungicides for control of all the major grape diseases in Ohio. In addition to efficacy, yearly evaluations of registered fungicides allows us to indirectly monitor fungicide resistance development in the endemic pathogen population, shifts in pathogen diversity and the impact of fluctuating environmental conditions on efficacy. As industry develops and markets new chemistries or biocontrol products we will test their efficacy and make comparisons to registered products.

   Deliverables
   A. Updated grape fungicide and biocontrol spray program recommendations (i.e. Midwest Grape Production Guide, Midwest Small Fruit and Grape Spray Guide, OSU Extension factsheets) for Ohio growers.
   B. Support registration and labeling of new materials in Ohio.
   C. Provide publishable data for a national database (Plant Disease Management Reports) used to prepare quantitative reviews of fungicide efficacy for managing grape diseases.

3. Create an Extension information/education web portal for Ohio wine grape growers. Web-based information delivery is not expected to displace traditional methods of information exchange, but to remain relevant in our rapidly changing information society more needs to be done with web-based educational programs and information. We will enhance the Buckeye Appellation website (http://ohiograpeweb.cfaes.ohio-state.edu) by adding a page dedicated to grape IPM. This page will include portals for information and resources for diseases, insects, weeds, and pest management. Each portal will be organized in a manner that provides IPM recommendations for organic and conventional grape production, year round IPM programs, and disease, weed, and insect image galleries for easy identification. The page will be developed so that it can be easily converted into a mobile application (long term goal).

   An OSU Grape IPM Facebook page will be launched to provide real-time information on upcoming outreach activities (i.e. workshops, trainings, new factsheets etc.), disease outbreaks, insect infestations, weeds problems, new pesticide regulations and other information related to grape IPM. The Facebook platform will bring local, national and international visibility to grape and wine production in Ohio.

*Indicates addition of FY17 projects effective 07/01/16.

*MUTUALLY AGREED-UPON PROJECTS FOR FY17 (continued)

A searchable web-based database will be constructed in three phases. Phase one will be constructed to allow grape growers to compare varieties based on disease resistant profiles, cold hardiness, fruit type and wine attributes. Users will be able to export the information as an Excel file or PDF. An example of a similar database for vegetables was developed by the PI and can be viewed at http://sites01.lsu.edu/faculty/mivey/recommended-varieties/. Phase two (year two) will expand on phase one to include registered pesticides for target pests and downloadable pesticide labels. Users will also be able to select multiple varieties for comparison purposes and a one page "variety snapshot" for each variety will be compiled and downloadable. Phase three will convert the database into a mobile application. Completion of phases 2 and 3 will be completed based on future funding opportunities.

An evaluation plan will be implemented to measure impact based on application usage (web statistics) and the relevance of the information as perceived by the growers using the applications (surveys).

Deliverables

A. A user friendly state of the art web-based information portal for extending grape IPM science-based IPM strategies and technologies.
B. A Facebook page for grape IPM in Ohio.
C. A searchable database to quickly identify registered pesticides, disease resistant varieties and wine attributes for grape varieties recommended for wine production in Ohio.

ENTOMOLOGY

As vineyards and wineries continue to grow in number in Ohio we must be mindful of the long- term sustainability of grape production because what we do now will shape the trajectory of our grape industry in the future. In managing insect pests of grapes, our key challenges are: 1) staying up to date on the activity and occurrence of grape pests in Ohio, both old and new; 2) evaluating our management practices to ensure they are still reliable and economically feasible for growers; and 3) balancing our reliance on chemicals with our use of cultural and biological controls to manage vineyard pests. These challenges can be addressed using Integrated Pest Management (IPM), which has the further benefit of minimizing the development of resistance in pests, as well as reducing unintended impacts on the environment and other non-target organisms. This proposal aims to address the 3 above-mentioned challenges with the goal of positioning growers to be proactive in their approach to managing insects, with an eye towards the sustainability and environmental integrity of their vineyard systems.

Expected Results and Deliverables

1. Continued collection of up-to-date information on the status and activity of invasive insects that have potential to threaten Ohio's grape industry (particularly spotted-wing drosophila), as well as identifying the "good" and "bad" (no ugly!) members of the insect community common to Ohio vineyards.
2. Developing a better understanding of insecticide efficacy and residual activity against grape pests so that we can better inform growers in their pesticide application decisions, with emphasis on grape phylloxera and spotted-wing drosophila.
3. Contribution to the annual revision of the "Midwest Small Fruit and Grape Spray Guide."
4. Delivery of research-based information on new technologies and products available for the management of grape insect pests in Ohio via extension presentations, newsletters, and online videos.

WEED SCIENCE

Weed Management of the Vineyard Floor; A Pro-active Approach. Selection of site and knowledge of weed populations are paramount in establishing a new vineyard. While many herbicides are registered to control annual broadleaf weeds and grasses in the vineyard, how and when to use the various options is confusing and worrisome to the grower. Moreover, creeping perennials such as thistle, various vines and woody species, and ground ivy continue to challenge most.

The first step in weed control is to eliminate perennial weeds before planting. This should be done by killing sod with one or more systemic herbicides not later than the autumn before planting vines. It is equally important to then begin the process of establishing a permanent sod ground cover between the rows, bearing in mind that a weed-free strip will usually be required directly under the trellis. Newly planted vines are more likely to be damaged by herbicides than vines that have been established for a year or more. Close examination of the labels of registered herbicides will show that in the year of planting only a few products can be used because of that fact.

*Indicates addition of FY17 projects effective 07/01/16.

*MUTUALLY AGREED-UPON PROJECTS FOR FY17 (continued)

The objective of the proposed research is to establish a multi-year experiment enabling evaluation of six sequential herbicide programs starting immediately after transplanting and continuing through the end of the fifth year when the herbicide Alion can be added to the program. In year 1 the initial six treatments will be one of: Treflan, Surflan, Prowl, Venue, Snapshot, or Roundup. Duration of weed control resulting from each application will be recorded as well as the identity of those weeds surviving treatment. Once weed control drops below 50% bare ground, plots will be retreated with the most appropriate herbicide depending on weeds present (eg Poast for grass escapes). The sequential nature of the treatments can be appreciated by considering that in the fall of the planting and second years, respectively, Chateau and Casoron can be added to the program. Further, in the spring of the second year Matrix can be added in addition to a reapplication of the herbicides used in spring of year 1. In year 3, Zeus Prime XC, Princep and Karmex can be added to the program, and so on through year 5 when Alion can be used for the first time. In addition to weed control, we will also measure vine growth and vigor, fruitfulness, and ground cover establishment. By focusing only on combinations of herbicides already registered for use in grape production we expect the research to position us to make practical recommendations for the best season long weed control with the least possible damage to fruit.

HERBICIDE DETECTION

Beta-testing of a mobile, field-deployable 2,4-D/dicamba detection system. The release of 2,4-D and dicamba tolerant corn, soybean, and cotton is imminent, beginning with 2,4-D tolerant corn. Farmers are expected to rapidly embrace these crops because they provide a new method to kill a growing range of glyphosate-resistant weeds. Employment of 2,4-D/dicamba resistant crops as a pest-management strategy, however, brings with it a set of risks that must be dealt with. Even modest adoption of this technology on 30% of the corn and soybean acreage in the Midwest will result in an increase in potential 2,4-D and dicamba use to six times the current usage. Even with advanced drift reduction technology in place, the increased use of these herbicides adjacent to sensitive crops will be such that crop injury resulting from off-site movement is highly likely, resulting in damage to sensitive crops, particularly grapes.

While new formulations of 2,4-D and dicamba can dramatically reduce drift, drift events can still occur, resulting in damage to vines and loss of yield. Depending on the concentration of 2,4-D or dicamba in a drift even, effects vary from occasional yield increases, to initial injury with complete recovery, to greatly reduced yield or death. The ability to rapidly detect drift compounds in the damaged crop is increasingly a deciding factor in preventing further damage or recovering financial losses in drift cases. In the case of 2,4-D and of dicamba, herbicides which mimic the plant hormone auxin, it is very difficult to detect residues with reliability and reproducibility using current analytical techniques if above-ground tissues are not collected within two to three days (48-72 h) of the drift event. Unfortunately, evidence of drift damage is usually not visible until the end of this period.

Our work has aimed to resolve the problem of longer-term 2,4-D detection by optimizing and beta-testing a proprietary detection system that sensitive crop growers can deploy in their fields. This system can be harvested post-drift, stored in the cold, and analyzed for the presence of 2,4-D after signs of damage become visible on the plant. Our preliminary results (funded in part by OGIC in 2013, 2014, and 2015), demonstrated that the current version of these detectors are able to successfully detect 2,4-D residues and withstand long-term storage.

Deliverables
1. Data determining which “Mark-II” detector matrix is best capable of withstanding exposure to rain, sun, wind, and heat.
2. An estimation of the length of time which the detection system (employing the best matrix composition) can be deployed in the field and still retain detectable 2,4-D residues.
3. A detection system ready for beta field deployment in the 2017 growing season, with OGIC partner vineyards.

ENOLOGY

1. Varietal Wine Evaluation (OARDC, AARS, and OSU South Center). Vineyards were set up at Wooster, Kingsville (AARS), and OSU South Centers as part of the original NE1020 variety trial collaborative project. Varieties at both Wooster and Kingsville have reached maturity for winemaking trials with a number of varieties being made from the 2011 through 2013 vintages. Varieties from OSU South Centers are considered to comprise more of an extension display vineyard that the OARDC Enology Program may also choose to vinify for the Southern region of the state. Although funding is not available through VCE, NE1020, and SCRI anymore, the enology program has also identified the importance of continuing to evaluate new varieties for their ability to grow in Ohio but more specifically related to their wine quality potential. We plan to continue our collaboration with Dr. Imed Dami on several promising and potential new varieties we have identified from these studies. Due to the past two harsh winters, we will be limited on the amount of grapes processed into wine for the 2016 vintage.

   We expect to produce wines from the New York and Minnesota selections to continue observing wine quality from these varieties for commercial interest. There will be several other hybrid varieties produced at Wooster, AARS or OSU South Centers that may be produced into wine as well under this section of research. We will keep track of wine quality from these varieties in tasting with members of our industry who may be considering a few of these varieties to replant some Vinifera or hybrid vines that did not make it through the past two winters. It is extremely valuable to have these wines available for use in educational formats in having winemakers taste any observed differences that the treatments may have in these practical studies. The following information below provides a brief overview of the wines vinified for this purpose.

*Indicates addition of FY17 projects effective 07/01/16.

*MUTUALLY AGREED-UPON PROJECTS FOR FY17 (continued)

Deliverables

A. Produce wine from varieties with high enough yields for evaluation of wine quality attributes
B. Taste wines with members of our industry who may be considering a few of these varieties to replant some Vinifera or hybrid vines that did not make it through the winter.
C. Provide recommended grape and wine quality fact sheets being disseminated to Ohio grape growers and winemakers
D. Addresses "best practices for wineries" in addition to "wine quality" deemed of high importance in the recent research and extension strategic planning process through OGIC.

2. The Effects of Hyperoxidation and Storage Temperatures on the Flavor Profiles and Sensory Qualities of Riesling Wine.
Approximately 75% of Ohio wineries produce white wines from cultivars with fruity or floral varietal characteristics (e.g., 'Vidal', 'Traminette', 'Riesling' and others). The quality of these wines is highly dependent on vintner practices that control the level of oxygen that the wine receives during the post fermentation and aging processes. Exposure to oxygen at any point in these processes is generally considered to have a negative impact on wine color, flavor and shelf-life.

However, there may be one exception, a process known as hyperoxidation. Using this technique, the winemaker purposefully introduces high levels of oxygen to recently pressed juice in order to initiate enzymatically controlled oxidation cascades of common phenolic constituents leading to the formation and precipitation of quinones (Moio et al., 2004; Ough, 1985; 1992). When these compounds are removed prior to vinification, they are excluded from the finished wine, leading to a product that is more shelf-stable, less off-colored, with fewer harsh or bitter flavor notes. However, the overall effects of hyperoxidation on wine flavor quality are still in dispute. Some studies indicate that hyperoxidation decreases the fruity and floral flavors that white wines typically contain and promotes the formation of new, unwanted compounds that are detrimental to wine quality (Nagel and Graber, 1988). In contrast, other researchers report that hyperoxidation of juice before alcoholic fermentation is associated with improved flavor, quality, and stability in the resulting product (Moio et al., 2004; Ough, 1992).

Storage can affect final sensory quality of white wine by modifying or decreasing characteristic hydroxycinnamic acids, flavanoids, and ester compounds, and by forming new detrimental flavor constituents leading to a reduction in quality (Kallithraka et al., 2009; Ough. 1985; Recamales et al., 2006). The rate of phenolic oxidation seems to increase within wines stored at higher temperatures (Kallithraka et al., 2009). Therefore, wines with lower concentrations of phenolic substrates through the process of hyperoxidation may be able to retain positive flavor constituents ultimately leading to longer shelf-life stability and aging potential.

Determining the identity and relative concentration of flavor compounds via gas chromatography-mass spectroscopy (GC-MS) is essential when evaluating wine flavor characteristics. The analyses are useful to quantify the effects of altered vinification parameters and provide a mechanism to relate vinification techniques to sensory evaluation of flavor quality. Terpenes, volatile ester compounds, and some low molecular weight phenolic compounds play a key role in white wine flavor and scent (Ferreira et al., 1996). However, the effects of hyperoxidation on the levels of these compounds are poorly documented. We hypothesize that the technique of hyperoxidation may increase the overall shelf-life, decrease flavor intensities initially, and will also reduce the development of oxidized off-flavor volatiles over time compared to control wines, especially at higher temperatures.

We have identified four objectives for verification of our main hypothesis:

A. Critically evaluate the overall effects of must hyperoxidation on Riesling wine phenolic levels
B. Examine the effects storage temperatures on the flavor quality and shelf-life of hyperoxidized Riesling wines
C. Determine the efficacy of different levels of applied oxygen during hyperoxidation of Riesling must samples
D. Distinguish whether or not the practice of hyperoxidation will improve the consumer acceptance and marketability of Riesling wines

2017 Deliverables

A. Laboratory-Scale Research (FY17): Volatile flavor compounds will be analyzed using SPME-GC-MS, Phenolic assays, and phenolic compound levels will be analyzed using HPLC-DAD.
B. Cellar-Scale Research (FY17): Information relating the effects of an optimized hyperoxidation/storage treatment combination and optimal oxygen addition levels on the color and volatile profiles of Riesling wines, the effects of these characteristics on wine quality as perceived by a trained sensory panel, and the attitude of the average consumer of hyperoxidated wines.
C. Consumer Research (FY17): Focus groups will be formed to determine what Ohio consumers want in white wines and how consumers are likely to react to hyperoxidation and its affects to the quality of white wines.

*Indicates addition of FY17 projects effective 07/01/16.

*MUTUALLY AGREED-UPON PROJECTS FOR FY17 (continued)

3. Lalvigne Study. Lalvigne is a yeast derivative product produced by Lallemand that is sprayed as a foliar application in the vineyard at 5% veraison with a second spray 10 to 12 days later. Lalvigne has been developed with the goal and intension of achieving both phenolic and enological maturity at the same time. This is attractive in a cool climate where growers desire to harvest earlier and avoid extended periods of rain, frost, and cool weather. Lalvigne is reported to help increase aromatic intensity for white wine varieties while also increasing body and mouthfeel in red wines. Currently, this work has been performed on Vinifera varieties with interest on its quality effects on hybrid white and red varieties common to the Midwest and Eastern section. Therefore, we will continue preliminary work on Traminette and Chambourcin vines for the 2016 vintage.

   Deliverables
   A. Perform chemical and sensory evaluation trials on both control and Lalvigne treated wine samples.
   B. Evaluate the effect of Lalvigne sprayed on Traminette and Chambourcin on overall wine quality.
   C. Taste experimental wines at enology workshops or the annual conference.
   D. Recommendations based on results will be disseminated to the Ohio commercial grape and wine industry at industry workshops, the annual Ohio Grape and Wine Competition or other extension related publication relating to the effect of Lalvigne on wine quality important factors to consider at harvest.

4. Dissolved Oxygen and Sulfur Dioxide (SO2) Correlation Study (*continuation with write up of study). A separate study not originally proposed in the production line item was developed based on the results of the dissolved oxygen study/survey during the bottling process of Ohio commercial wineries. This study was designed to determine the influence of free SO2 at various dissolved oxygen levels and storage intervals on white wine quality. When wine is exposed to extensive aeration, oxidation usually occurs with a decrease in wine quality. The most common oxidation flaw results in a nutty, sherry-like aroma with a brown color. To control wine chemical oxidation, dissolved oxygen should be maintained at a minimum of l0 ppm at the time of bottling. In addition, it is essential to add adequate amounts of free SO2 to obtain 10 ppm free SO2 throughout bottle storage. Sulfur dioxide is a powerful anti-oxidant and consumes 4 ppm of dissolved oxygen per 1 ppm free SO2. For this reason, most SO2 amounts are increased to extreme levels to compensate for high dissolved oxygen levels. The consequence of this is undesirable sensory attributes such as, pungent odor and bleaching of color. Also, some recent studies indicate that higher levels of SO2 may diminish the ratings for delicate varietal fruit and various other positive sensory attributes in aroma.

   Deliverables
   A. Analyze the data to observe if simply adding additional amounts of sulfur dioxide based on oxygen content is an acceptable practice as related to sensory evaluation results.
   B. Try to correlate if there is a limit to the amount of oxygen and sulfur dioxide addition according to sensory evaluation over time.
   C. Results will be disseminated at future OARDC enology workshops, the Ohio Grape and Wine Conference in addition to the annual report to OGIC.

5. Research Studies and Varietal Wine Production for Extension Purposes. Several small scale enology studies will also be performed specifically for the educational benefit of Ohio commercial winemakers. These studies are mainly focused on extension related activities with the purpose of directly observing the results through tasting wines in an educational setting. Results and tastings will be performed at various workshops, wine making forums, site visits or conferences. Although not listed below, other small scale studies under this focus may evaluate specific yeast or bacterial strains in addition to other potential cellar treatments of potentially enhancing wine quality for a particular variety.

*Indicates addition of FY17 projects effective 07/01/16.

COST SUMMARY

Ohio Grape Industries Extension and Research Program
CSP900113

UNSPSC CATEGORY CODE: 93141905, 70141705

OAKS ITEM NUMBER: 11942

Description	Year 1 Cost	Year 2 Cost	Year 3 Cost	Year 4 Cost	Year 5 Cost
1. Extension Services					
Extension Services	$ 172,716.00	$ 189,593.00	$ 203,427.00	$ 202,779.00	$ *209,784.00
Category Total	**$ 172,716.00**	**$ 189,593.00**	**$ 203,427.00**	**$ 202,779.00**	$ *209,784.00
2. Viticulture Research					
1. Viticulture	**Year 1 Cost**	**Year 2 Cost**	**Year 3 Cost**	**Year 4 Cost**	**Year 5 Cost**
a. Evaluation of Crown Gall-Free grapevines	$ 9,012.00	$ 9,192.00	$ 3,132.00	$ 0.00	$ 0.00
b. Evaluation of training systems for Cabernet Franc	$ 10,014.00	$ 10,215.00	$ 3,132.00	$ 0.00	$ 0.00
c. Winegrape variety evaluation – Ne 1020 Project	$ 10,000.00	$ 12,700.00	$ 3,132.00	$ 0.00	$ 0.00
d. Winegrape variety selection evaluation with improved cold hardiness	$ 7,010.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00
e. Clonal evaluation of Cabernet Franc.	$ 9,012.00	$ 9,192.00	$ 3,132.00	$ 0.00	$ 0.00
f. Rootstock Evaluation for Traminette and Chardonel	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00
g. Winter protection of grapes using ABA	$ 15,000.00	$ 15,300.00	$ 0.00	$ 0.00	$ 0.00
h. Implementing Best Viticulture Practices		$ 15,000.00	$ 3,132.00	$ 0.00	$ 0.00
Managing Vines after Winter Injury	**Year 1 Cost**	**Year 2 Cost**	**Year 3 Cost**	**Year 4 Cost**	**Year 5 Cost**
a. Cordon and Trunk Management			$ 9,397.00	$ 0.00	$ 0.00
b. Rootstock and Clonal Evaluation			$ 9,397.00	$ 0.00	$ 0.00
c. Pruning Decisions in Hybrids			$ 9,397.00	$ 0.00	$ 0.00
d. Sucker Management			$ 9,397.00	$ 0.00	$ 0.00
e. Commercial Vineyards Trials			$ 9,397.00	$ 0.00	$ 0.00

*Indicates updated FY17 costs and re-pagination effective 07/01/16.

f. Developing a Training System for Winter-Damaged Grapevines				$ 12,631.00	$ 0.00
g. Trunk Renewal and Sucker Management				$ 12,631.00	$ 0.00
h. Evaluation of Crown Gall Sensitivity in Grape Varieties				$ 12,631.00	$ 0.00
i. Managing Winter Damage in Commercial Vineyards				$ 12,631.00	$ 0.00
j. Evaluation of Performance and Cultural Practices of Promising Winegrapes				$ 12,631.00	$ 0.00
*FY17 Projects					$ *61,471.00
Viticulture Total	$ 60,048.00	$ 71,599.00	$ 62,465.00	$ 63,155.00	$ *61,471.00
2. Plant Pathology	**Year 1 Cost**	**Year 2 Cost**	**Year 3 Cost**	**Year 4 Cost**	**Year 5 Cost**
a. Evaluation of currently available and experimental fungicides	$ 3,023.80	$ 3,106.60	$ 0.00	$ 0.00	
b. Collect infected grape canes and document pycnidia formation and sporulation	$ 3,023.80	$ 3,106.60	$ 0.00	$ 0.00	
c. Determine the conditions required for sporulation of P.viticola on infected grape canes and develop a predictive model	$ 3,023.80	$ 3,106.60	$ 0.00	$ 0.00	
d. Determine the effects of dormant applications of a potential substitute for Liquid Lime Sulfur (Sulforix) on the development of Phomopsis cane and leaf spot and other grape diseases in Ohio, and the effects of dormant applications of phosphorous acid on control of grape diseases.	$ 3,023.80	$ 3,106.60	$ 0.00	$ 0.00	
e. Determine the efficacy of a new biological control agent and soil amendments of compost for control of grape crown gall.	$ 3,023.80	$ 3,106.60	$ 0.00	$ 0.00	
f. Sustain Ohio grapevine productivity by surveying virus and phytoplasma disease damages to vineyards across the state.			$ 23,033.00	$ 0.00	
g Identify Disease-Causing Viruses and Phytoplasmas in Ohio				$ 12,000.00	
h. Determine Statewide Distribution of Identified Pathogens				$ 8,000.00	

*Indicates addition of FY17 costs and re-pagination effective 07/01/16.

i. Assess Grape Production Losses Caused by these Pathogens				$ 3,033.00	
*j. Statewide Distribution of Grapevine Viruses					$ *11,636.00
*k. Maintaining a Successful Integrated Disease Management Program for Ohio Grape Growers					$ *11,030.00
*l. Create a web portal for Ohio wine grape growers					$ *7,005.00
Plant Pathology Total	$ 15,119.00	$ 15,533.00	$ 23,033.00	$ 23,033.00	$ *29,671.00
3. Entomology Section to be awarded after 08/01/12.	**Year 1 Cost**	**Year 2 Cost**	**Year 3 Cost**	**Year 4 Cost**	**Year 5 Cost**
a. Develop more effective scouting protocols and pest management strategies to control invasive pests in Ohio vineyards, including but not limited to Multi-Colored Lady Asian Beetle, Marmorated Stink Bug, Spotted Wing Drisophila and European Berry Moth.	$ 14,608.00	$ 20,214.00	$ 20,214.00	$ 0.00	
b. Evaluate Movento for control of grape scale.	$ 4,804.00	$ 2,000.00	$ 2,000.00	$ 0.00	
c. Evaluate Movento and leverage for annual and long term control of grape phylloxera.	$ 4,804.00	$ 2,000.00	$ 2,000.00	$ 0.00	
d. Statewide systematic monitoring of Spotted Wing Drosophila (SWD), comprehensive training of growers in SED monitoring and identification, and insecticide efficacy studies of SWD.	$ 0.00	$ 5,000.00	$ 5,000.00	$ 0.00	
e. Monitoring and Managing Invasive Pests in Ohio Vineyards				$ 13,000.00	
f. Evaluating Admire Pro, Movento and Leverage for Control of Grape Phylloxera				$ 6,000.00	
g. Monitoring and Management of Japanese Beetles				$ 3,000.00	
h. Grower Outreach and Consultation				$ 1,714.00	
i. Midwest Small Fruit and Spray Guide Development				$ 500.00	

*Indicates addition of FY17 costs and re-pagination effective 07/01/16.

*j. Informing Management Strategies for the Good, Bad and Ugly Insects in Ohio Vineyards					$ *23,651.00
Entomology Total	$ 24,216.00	$ 29,214.00	$ 29,214.00	$ 24,214.00	$ *23,651.00
4. Weed Science	**Year 1 Cost**	**Year 2 Cost**	**Year 3 Cost**	**Year 4 Cost**	**Year 5 Cost**
a. Continue development of new and improved herbicides, alternative weed control techniques and weed management systems that will provide more efficient, cost effective and environmentally sound weed control in Ohio vineyards.	$ 5,700.00	$ 5,700.00	$ 0.00	$ 0.00	
b. Optimization of mobile detector deployment strategies for 2,4-D and dicamba drift.	$ 0.00	$ 6,500.00	$ 6,500.00	$ 0.00	
c. Improved weed control for winter-hilled vines			$ 5,700.00	$ 5,800.00	
*d. Weed Management of the Vineyard Floor					$ *5,696.00
Weed Science Total	$ 5,700.00	$ 12,200.00	$ 12,200.00	$ 5,800.00	$ *5,696.00
5. Herbicide Detection	**Year 1 Cost**	**Year 2 Cost**	**Year 3 Cost**	**Year 4 Cost**	
a. Complete Weather Optimization of 2,4-D/dicamba Detection System				$ 7,700.00	
b. Beta Field Deployment Trials of the 2,4-D Detection System in Vineyards				$ 9,800.00	
*c. Beta-testing of a mobile, field-deployable 2,4-D/dicamba detection system					$ *16,600.00
Herbicide Detection Total				$ 17,500.00	$ *16,600.00
Category Total	$ 105,083.00	$ 128,546.00	$ 127,092.00	$ 133,702.00	$ *$130,084.00
3. Enology Research					
1. Enology research focused on producing premium quality wine in Ohio:	**Year 1 Cost**	**Year 2 Cost**	**Year 3 Cost**	**Year 4 Cost**	**Year 5 Cost**
a. Identify vinification practices in determining optimum procedures of enhancing varietal character.	$ 13,037.00	$ 9,567.40	$ 7,729.00	$ 0.00	
b. Investigation of new yeast and bacteria strains in producing higher quality and more complex wines.	$ 6,520.00	$ 7,653.40	$ 0.00	$ 0.00	

*Indicates addition of FY17 costs and re-pagination effective 07/01/16.

c. Emphasis on aromatic volatile research by optimizing the GC/MS.			$ 0.00	$ 0.00	
d. Investigation of new techniques of controlling both chemical and microbial wine stability.	$ 8,691.00	$ 0.00	$ 0.00	$ 0.00	
e. Effect of tannin addition on Cabernet Franc and Chambourcin wine quality		$ 13,085.40	$ 0.00	$ 0.00	
f. Effect of hyperoxidation on Riesling and Pinot Gris wine quality.		$ 4,894.40	$ 0.00	$ 0.00	
g. Effect of oxygen management on terpene and ester levels in white wines		$ 15,810.00	$ 24,734.00	$ 0.00	
h. Best Viticultural Practices		$ 5,930.00	$ 10,821.00	$ 7,480.00	
i. Varietal Wine Evaluation (OARDC, AARS and OSU South Center)				$ 10,472.00	
j. Effects of Hyper-oxidation on Terpene and Ester Levels in Riesling				$ 23,935.00	
k. Research Studies and Varietal Wine Production for Extension Purposes				$ 17,813.00	
Enology Research for Premium Quality Wine	$ 28,248.00	$ 48,874.00	$ 43,284.00	$ 59,700.00	
2. Collaborative Enology research focused on enhancing both grape and wine quality for Ohio:	**Year 1 Cost**	**Year 2 Cost**	**Year 3 Cost**	**Year 4 Cost**	**Year 5 Cost**
a. Evaluate cultural practices in the vineyard that optimize vine performance and fruit quality for wine quality enhancement.	$	$	$ 0.00	$ 0.00	
b. Evaluate clones and rootstocks of existing and newly introduced varieties for enhancing wine quality (e.g. Cabernet franc, Riesling, Gamay noir, etc.)	$	$	$ 0.00	$ 0.00	
c. Evaluate newly released varieties and advanced selections for grape and wine quality in Ohio. Varietal wine production for extension presentations and functions.	$ 6,519.00	$ 7,653.40	$ 18,551.00	$ 0.00	
d. Develop standards of fruit maturity for varietals in Ohio in the production of premium wine.	$ 4,345.00	$ 0.00	$ 0.00	$ 0.00	
e. Work with other disciplines involving Entomology, Plant Pathology and Weed Ecology on possible studies effecting wine quality	$	$	$ 0.00	$ 0.00	
Enology Research to Enhance Grape and Wine Quality	$ 10,864.00	$ 0.00	$ 0.00	$ 0.00	

*Indicates addition of FY17 costs and re-pagination effective 07/01/16.

*FY17 Projects					$ *71,833.00
Category Total	**$ 39,112.00**	**$ 64,594.00**	**$ 61,835.00**	**$ 59,700.00**	**$ *71,833.00**
Commercial Expansion of New Varieties to Ohio			$ 1,500.00	$ 2,800.00	
Grand Total	**$ 316,911.00**	**$ 382,733.00**	**$ 393,854.00**	**$ 398,981.00**	**$ *418,706.00**

*Indicates addition of FY17 costs and re-pagination effective 07/01/16.

All costs must be in U.S. Dollars.
The State will not be responsible for any costs not identified.
There will be no additional reimbursement for travel or other related expenses.

CONTRACTOR INDEX

CONTRACTOR AND TERMS:

*BID CONTRACT NO.: CSP900113-1

678 (address 48)
The Ohio State University
Office of Sponsored Programs
1960 Kenny Road
Columbus, OH 43210-1063

TERMS: Net 30

CONTRACTOR'S CONTACT:

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*Administrative/Fiscal Contact:

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*Indicates re-pagination effective 07/01/15.

SUMMARY OF AMENDMENTS

Amendment Number	Effective Date	Description
10	07/01/16	To renew the contract for an additional twelve (12) months, effective July 1, 2016 through June 30, 2017, add the FY17 approved projects, update the Cost Summary, update the Administrative Contact and re-paginate the document.
9	07/01/15	To renew the contract for an additional twelve (12) months, effective July 1, 2015 through June 30, 2016, change the Administrative/Fiscal Contact and update the Cost Summary for FY16.
8	10/27/14	To change the expiration date of the contract and to add the mutually agreed-upon provision regarding equipment.
7	08/01/14	Issued to renew the contract for an additional twelve (12) months, effective August 1, 2014 through July 31, 2015. In addition, this amendment is issued to include budgeted projects for FY15 for this contract; and, an update to the Contractor's contact.
6	07/01/14	To renew the contract for an additional twelve (12) months, effective July 1, 2014 through June 30, 2015.
5	07/19/13	To add new projects, update the budget amounts with FY14 funding and re-paginate the document.
4	08/24/12	To correct the FY13 totals for Viticulture Research and Grand Total and to correct the OAKS vendor address code.
3	08/08/12	To add the Entomology costs and include these costs in the Grand Total amounts.
2	07/13/12	To correct Weed Science and Grand Total amounts for Years 1 and 2.
1	07/06/12	To correct Grand Total amount in Year 1 and Plant Pathology Total, Viticulture Research Category Total and Grand Total amounts in Year 2.