NOTE FROM THE EDITOR

Spring is here! Reports of bud swelling to early signs of budbreak have been rolling in across the state. So far, things are looking pretty good, albeit some concerns relating to cold damage from our March 2018 cold snap (keep an eye out for crown gall). Otherwise, the snow pack is looking good, spring rains are keeping the soils moist (but a little cool), and the season appears to be tracking fairly close to average.

As you catch a small breather between the end of pruning and the start of pest management, enjoy this spring issue of VEEN. We have several articles on what is new, what to look out for, and things to look forward too.

As always, check the WSU V&E Program’s website frequently, as we have a number of events for 2018 where we hope to see you!

Michelle M. Moyer
Associate Professor-Viticulture Extension Specialist
WSU-Prosser
Detecting DMI Resistance in Powdery Mildew
By the Fungicide Resistance Assessment, Mitigation, and Extension (FRAME) Network

If you heard one the FRAME Network group talks about fungicide resistance in grape powdery mildew this past winter, this past winter. We hinted we would soon have a DMI-resistance (FRAC 3) screening test similar to the test we have for QoI fungicides (FRAC 11; QoI or strobilurin). You may be wondering: When will I be able to submit samples for potential DMI resistance screening? Is the test available yet?

The short answer - No; it is still a work in progress. While we can detect and quantify some of the mutations associated with DMI fungicide resistance, we are not sure what the testing results mean for field samples, and the potential of DMI control failures.

The long answer – Kind of. We have a PCR-based assay that can detect and accurately quantify the Y136F mutation in the CYP51 gene that is associated with DMI resistance. The problem is that the association between the mutation and actual field-level resistance is not clear.

Assume that 20 mutant gene copies per cell are needed to cause a control failure (actual number is not known) and that each mildew isolate had the same tolerance to DMI fungicides as sensitive isolates without any known mutation. The problem is that there are numerous copies of genes per cell; which could suggest a low risk DMI fungicide failure. But that is not true! In fact, 25% (1 of the 4) of your isolates (isolate #4) are resistant, meaning they contain more mutant gene copies than the threshold for control failure. The subsequent use of DMI fungicides could allow this resistant isolate to rapidly increase; and if those DMI fungicides are used at a critical time (i.e., bloom to late fruit-set) a field control failure could be likely. We could be falsely thinking that we can use DMI fungicides when instead we should be implementing strict fungicide resistance mitigation practices.

The conservative approach to using this data would be to not use any
DMI fungicides if a Y136F mutation is detected. But this conservative approach also has some drawbacks - if we stop using DMIs when only a single mutant gene is detected, we would be placing undue resistance development pressure on the remaining fungicide modes-of-action. It likely takes a lot of copies of the mutant gene in order to get to the point of field-level control failures, considering we have been living with DMI resistance since 1996.

To make things even more complicated, we also have found powdery mildew isolates without the Y136F mutation but resistant to the DMIs tested (mcylobutanil and tebuconazole). This means that you could get a negative test result back (no Y136F detected), but still have DMI resistant powdery mildew isolates. This tells us that the Y136F mutation is likely not the only genetic trait associated with DMI fungicide resistance in the field.

As the FRAME Network group, we are expanding our sample testing in 2018 to improve our understanding of how to use these tools and interpret results. We are not confident that existing genetic tests can be used to make accurate field management decisions regarding the DMI fungicides because of our limited understanding of mutation frequency.

One last point. The fungicide resistance data to date is only representative of the samples we received. Since these samples were not randomly collected, they do not represent the state of the powdery mildew population in any region. We also do not know how many samples are needed to make an accurate management decision. This is ongoing research that is partially funded by the American Vineyard Foundation.
The USDA-funded VitisGen2 project is aimed at using detailed DNA sequence information to incorporate disease resistance genes into new cultivars. Breeding for disease resistance is a worldwide effort to address weaknesses in our leading wine grape cultivars.

The need. The most popular cultivars of the domestic grapevine, Vitis vinifera, contain a tiny fraction of the genetic diversity present in the entire Vitis genus. Most of these venerated cultivars, such as Pinot noir, Riesling, Chardonnay, etc., emerged during the Middle Ages in Europe, long before foreign pests and pathogens were introduced from the New World. Recent efforts to map the grape genome revealed that 75% of common V. vinifera cultivars tested share immediate family with at least one other cultivar—meaning that they are all siblings, parents, or children to each other. It's not surprising, then, that grapes today are so susceptible to disease.

The weakness. Disease susceptibility. The invasions of phylloxera, black rot, and downy powdery mildews in Europe initiated adaptations to viticulture such as hybridization with North American species, grafting to North American species rootstocks, and the use of broad-spectrum fungicidal chemistry (e.g. “Bordeaux mixture,” copper sulfate and slaked lime).

Many in the wine industry are aware of the unfortunate reputation and fate of the interspecific hybrids: they were a temporary solution to the phylloxera problem, bred hastily in the mid-1800s, with little regard for flavor and wine quality. V. vinifera cultivars quickly reclaimed their place back from the hybrids with the advent of grafting. Grafting was almost universally adopted, and rootstock breeding continues today to make progress in optimizing vine performance. However, fungal disease management still remains a problem. For example, growers in humid climates often have to apply 8-15 fungicide sprays per season to adequately protect their V. vinifera vines—this is undeniably unsustainable, considering intensive resource use and the evolution of fungicide-resistant pathogens.

The solution. Resistance genes from North American Vitis. How can such a massive shortcoming of our globally-preferred grape species be addressed? The answers lie in the genetics of North American and Asian species of Vitis, species which evolved alongside the aforementioned pathogens for millions of years. Access to those answers lies in novel genetic sequencing technologies and advances in breeding and automated phenotyping. It helps that the price of genetic sequencing has plummeted in the past 10 years, from $500 to sequence a mega-base (1 million base pairs) in 2007, to just 1.2 cents today. All of these factors facilitate progress towards developing new, disease resistant varieties, with traits for fruit and wine quality prioritized alongside disease resistance.

The VitisGen2 project brings together a multi-disciplinary team whose goal is to produce game-changing grapes. In the deluge of newly-available genetic information, VitisGen geneticists have identified more than 70 markers associated with quantitative trait loci (QTLs) for disease resistance and fruit quality since 2011. These markers are useful to breeders, who stack or “pyramid” those genes in the offspring for strong, long-term disease resistance. This is a world away from the capabilities of grape breeders in the 19th century, or even in the late 20th century—they are no longer flying blind towards their goals.

The Challenge. Perhaps the largest challenge that will remain in the way of new varieties for sustainable, high quality grape production is industry and consumer acceptance. Wine is steeped in tradition, entwined with the history and culture of humanity for thousands of years. The most popular V. vinifera varietal wines and traditional blends have loyal followers who gravitate towards those wines because they expect consistency, and/or are interested by the historical and cultural associations of the wine. However, it does not have to be a mutually exclusive situation: new cultivars and old cultivars can each fulfill a niche that the other cannot. In fact, Europe is beginning to embrace new, disease resistant cultivars—watch the latest VitisGen webinar for more on that topic.

We have entered a new era of genetic information, where in just 10 years, the cost of DNA sequence has dropped by a factor of 10,000. The potential for breeding resilient, flavorful grapes is better than ever. For the sake of responsible environmental stewardship and conscientious consumption, it is time for wine lovers to open their minds and expand their palates to cultivars coming in the 21st century.

This research was supported by the USDA-NIFA Specialty Crop Research Initiative (Award No. 2017-51181-26829)

References:


Herbicide Use and Weed Management Survey
By Lynn Sosnoskie, formerly of WSU - Wenatchee, currently UC-ANR Agronomy and Weed Science Advisor

Weed control is a critical component of newly established and bearing vineyards. Weeds compete for water, nutrients, and light, which can affect yield quantity and quality. In addition to direct interference, non-managed weeds can negatively affect vineyard production by: blocking sprinklers resulting in micro-sites that are alternately drought- and flood-stressed; supporting populations of insect, rodent, and pathogenic pests detrimental to crop health; and interfering with harvest activities. Weeds are also incredibly adaptive organisms; as a result, the structure and composition of in-vineyard plant communities are constantly evolving in response to vegetation management strategies. To better develop weed science-related research and extension efforts that directly benefit Washington’s (WA) wine grape industry, current and detailed information describing current weed management practices and future weed control issues in vineyards is needed.

A voluntary survey activated on 18 Nov 2017 and was distributed to vineyard managers via the WSU Irrigated Agriculture Newsletter, mailing information managed by www.washingtonwine.org and www.wawinegrowers.org, and through social media (Facebook and Twitter). The survey, which was conducted online at the Washington State University (WSU) Qualtrics website was composed of 18 questions divided into five sections that captured the following information: 1) what AVAs are represented and how many acres are managed by the respondents, 2) what pre- and post-emergence herbicides are used underneath the trellis system, 3) what non-chemical weed management strategies are also employed, 4) which weeds are most problematic, and 5) what research needs are important to growers going forward.

The survey had twenty-nine respondents, who were responsible for managing 10,000 acres. According to WSU estimates, this represents approximately 20% of the total wine grape acreage in the state. Most of the respondents were from the Columbia Valley AVA (16%), the Horse Heaven Hills AVA (24%), and the Walla Walla Valley AVA (11%). Three to 5% of the respondents managed grapes in each of the remaining WA AVAs except Columbia Gorge, Snipes Mountain, Naches Heights, and Ancient Lakes (0% of respondents reported working in these AVAs). Across all respondents, 57% of the wine grape acres were listed as bearing (43% non-bearing), 44% of the acres were listed as USDA certified organic or transitioning to organic (54% not under USDA organic certification), and 14% were listed as LIVE certified (86% not LIVE certified).

With respect to herbicides, 59% of respondents indicated that they had used pre-emergence (PRE) herbicides at some time during the last three years. Surflan (oryzalin), Matrix (rimsulfuron), Alion (indaziflam), and Chateau (flumioxazin) were the most commonly used products (Fig.1); Casoron (dichlobenil), Goal (oxyfluorfen), Karmex (diuron), Prowl (pendimethalin), and Solicam (napropamide) were each used by 3-5% of all respondents. Eighty-three percent of all respondents reported using post-emergence (POST) herbicides under the trellis system for weed control at some time during the last three years, with glyphosate containing products being the most common choice followed by Aim (carfentrazone), Rely (glufosinate), and Gramoxone inteon (paraquat) (Fig. 2). Venue (pyraflufen ethyl) was used by 6% of the respondents and 2% had reported using Poast (sethoxydim).

Figure 1 - The most commonly used PRE herbicides in WA wine grapes according to a survey of wine grape growers and vineyard managers.

Although herbicides appeared to be important components of weed management programs in WA wine grapes, they were not the only tools employed; 38%, 32%, and 28% of respondents also reported using cultivation, mowing and hand-weeding, respectively, for weed management under the trellis...
Herbicides, con’t.

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system. Weed control between the rows was achieved through a combination of mowing (43% of respondents), cover cropping (25%), cultivation (19%), hand-weeding (7%), and herbicide applications (7%).

According to the respondents, summer broadleaf species (e.g., pigweeds) were primarily considered to be a big problem in vineyards, whereas summer (e.g., crabgrass) and winter (e.g., annual bluegrass) grasses and winter broadleaves (e.g., filaree) were less significant concerns (Fig. 3). Perennial broadleaves (e.g., field bindweed) were, primarily, reported to be a moderate concern and perennial grasses/or grass-like species (e.g., horsetail) were described as a big to serious problem (Fig. 4).

When asked to identify individual species of concern, growers specifically mentioned: *Salsola tragus* (Russian thistle), *Tribulus terrestris* (puncturevine/goatheads/caltrops), *Conyza canadensis* (marestail), *Kochia scoparia* (kochia), *Amaranthus spp.* (pigweed), *Centaurea spp.* (knapweed), and *Malva neglecta* (common mallow). With respect to herbicide resistance in their vineyards, the respondents specifically noted: *Conyza canadensis*, *Kochia scoparia*, and *Salsola tragus*. These results are not surprising as resistance to glyphosate has been reported for several listed species (Russian thistle, marestail, Kokia, and pigweeds) in the Western United States (http://weedscience.org/default.aspx).

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Figure 2 - The most commonly used POST herbicides in WA wine grapes according to a survey of wine grape growers and vineyard managers.

Figure 3 - Importance of annual weed species in WA wine grapes according to a survey of wine grape growers and vineyard managers.
Herbicides, con’t.

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With respect to future management needs, growers indicated interest in: finding new, effective herbicide for weed control, but also reducing total herbicide use; evaluating new cultivation equipment while also improving the adoption of reduced tillage; and identifying weed suppressive cover crops (in particular, native plant species).

Results from this survey, which was funded by a grant from the WA State Grape and Wine Research Program, suggest that vineyard managers utilize a diverse set of strategies to manage weeds in their production systems. Tools include both pre- and post-emergence herbicides, mowing and cultivation, hand-weeding, and cover crop use. While the identification of new herbicides for use in wine grape systems is desirable, reducing the industry’s reliance on chemical control strategies also appears to be of interest. Cultivation practices can be an effective alternate weed management strategy; however, growers appear to be interested in minimizing soil disturbance. Many of the species listed as specific concerns to growers are known to be resistant to glyphosate in other Western states, although resistance has not yet been confirmed in WA. Several of these species can also be widely dispersed by wind-blown seeds (marestail) or tumbling plants (Kochia and Russian Thistle). Several species (Centuarea spp., common mallow, Kochia, puncturevine, Russian thistle) are adapted to the drier environments that characterize the Eastern side of the state. Future research efforts should be sure to address the influence of weed biology and physiology on management success.

![Figure 4 - Importance of perennial weed species in WA wine grapes according to a survey of wine grape growers and vineyard managers.](image)

NOT RECEIVING WSU V&E EXTENSION EMAILS?

Go to our website: [http://irrigatedag.wsu.edu/](http://irrigatedag.wsu.edu/)

This service allows you to customize the information you receive. Choose from topic areas, including: Tree Fruit (apple, cherry, stone fruit, nursery, automation/mechanization), Grapes (juice, wine, table, winery), Other Small Fruit (blueberry, raspberry), Vegetables (potato, onion, sweet corn, peas, carrots, other vegetables), Cereals/Row Crops (wheat/small grains, corn [grain and silage], dry edible beans, alternative crops), Forages (alfalfa, timothy, other grasses/legumes, mint), Livestock (cattle, swine, sheep, goats, pasture management), Ag Systems (high residue farming, soil quality/health, organic ag, direct marketing, small farms), Water and Irrigation (center pivot irrigation, drip irrigation, surface irrigation, water availability/rights).
These Caterpillars Can Sure Mess Up Grape Leaves!

By David James, WSU-Prosser

Caterpillars (common name: Leaffolders) which roll grapevine leaves while consuming them, have recently emerged as a localized pest in Washington vineyards with outbreaks reported from a few locations in the Yakima Valley and around Mattawa (Fig. 1). In some instances, near-defoliation has occurred on young vines and concern has been expressed by growers on the possible effect of this damage on fruit ripening. Insecticides have been used in some cases to attempt to minimize the impact of leaffolders on grapevines.

The identity of the caterpillars causing the leaf-rolling problem is unclear but preliminary studies in September 2017 by our lab at WSU-Prosser indicate that at least some of the outbreaks are being caused by Desmia funeralis or Desmia maculalis (Grape leaffolder moths, Fig. 2). Michelle Moyer also indicated D. funeralis was responsible for scattered reports of leaf folding in Washington in 2014 (Moyer 2014). Desmia funeralis is a well-known pest in California viticulture (Flaherty et al 1992) but its natural distribution also includes the Pacific Northwest.

Much confusion exists between D. funeralis and D. maculalis and the importance of each as a grape pest. Currently, it is unknown whether all the outbreaks of leaffolder damage in Washington vineyards can be ascribed to one or both of these moth species or whether there are other species involved.

The arrival of a new pest in Washington wine grape vineyards, particularly one that is beginning to appear in high abundance at some sites causing economic damage, demands our attention as researchers and viticulturists. We need to identify the distribution and extent of damage being caused by leaffolders in Washington vineyards. We also need to accurately determine the caterpillar species causing this damage so that management strategies can be developed. The research we hope to conduct over the next few seasons will elucidate and evaluate the threat posed by leaffolders to sustainable grape production in Washington. It will also provide a road map for the way forward that maintains sustainable biologically-based pest management.

Have you had leaffolders in your vineyard? We want know! (email: david_james@wsu.edu). This spring and summer, we will be collecting leaffolder caterpillars from as many vineyards in eastern Washington as possible. We will rear-out and identify all of the species we find, giving us a baseline of information on species identity, distribution and abundance.

We will also be looking for evidence of parasitism as these caterpillars are known to be susceptible to a number of different wasp parasitoids. These parasitoids have the potential to keep leaffolders in-check. The seasonal biology of leaffolders will be studied at selected vineyards to determine the phenology of life stages (eggs, caterpillar stages, pupae, adults) and generations. Information and data gained during this project should allow formulation of potential management strategies. If the species involved are vineyard pests elsewhere then it is likely that we can quickly adopt to a greater or lesser degree management options that are already tested and proven. Most importantly we will be able to answer the question: Should we worry about leaffolders?

References:

As many of you might be aware, a new licensing law went into effect in January 2017 that could impact your business. This new licensing law requires those who use sulfur dioxide (SO₂) in the winery to potentially obtain a pesticide applicator’s license with a “Limited Specialty” endorsement. Those who already have a license for use of sulfur dioxide gas on wine corks and barrels, and who were current with their license registration at the time the law went into effect, were grandfathered in. Those who are new licensees or who did not meet requirements for recertification, will have to take the new exam to earn the endorsement. The new exam is short, does not have any study materials, and will be based on a sulfur dioxide label and application manual.

If you do not currently have a pesticide applicator’s license, and are looking to obtain one with an endorsement to allow you to use SO₂, then there are two licensing options to choose from, as shown in the Flowchart below (modified from L. Moses, WSDA). The type of license you need depends on where you get your grapes from to make wine. If you make wine ONLY from grapes you grow yourself, then you need a Private Applicator’s license, and do not need to take the special endorsement test. The Private Applicator’s license requires you to obtain 20 recertification credits every 5 years to keep the license current (along with paying annual fees). If you make wine with grapes grown by another farm / company, then you need a Private Commercial Applicator License, and you will have to take the exam for the SO₂ endorsement. This license requires that you earn 40 recertification credits every 5 years (along with paying annual fees).

The majority of WA wineries will likely need the Private Commercial Applicator’s license. This difference in credits between the two license types is very important.

For more information related to this new endorsement, please contact Lindsey Moses, Pesticide Licensing Specialist at the WSDA. Email: LMoses@agr.wa.gov; Phone: (360) 902-2027.

For more information on recertification please visit: https://agr.wa.gov/PestFert/docs/Form4222.pdf
For the second straight year, the state grape and wine research program will award more than $1 million in research grants for 2018-19. This year’s research funding of nearly $1,009,000 is 30% higher than funding five years ago of $776,280 and just under last year’s record $1,053,000.

The Washington State Wine Commission approved the funding recommendations put forth by its subcommittee, the Wine Research Advisory Committee, to award 17 research project grants from the Washington State Grape and Wine Research Program.

Vineyard health is a major research focus. Several projects deal with grapevine diseases, insect pests, including a new leaffolder moth, irrigation water savings and efficiencies, vine heat stress, and new spray application technologies. Winery research projects funded include tannin management, wine quality impacts from mechanization, wine spoilage, sensory characteristics of wine, and the impact of pH on wine microbial ecology.

Two new projects that will be initiated this year address labor shortages that are occurring in Washington vineyards. One project aims to develop a precise mechanical solution for shoot thinning, and the second new project will work on a smartphone application to estimate crop load.

The grape and wine research program is a competitive grant program administered by Washington State University. The program has a unique four-way funding partnership unlike any in the nation that blends industry, state, and private monies from:
Wine spoilage from the yeast *Brettanomyces bruxellensis* is a concern, if not a major threat, to red wine quality. Additional research regarding those factors that impact its growth and ability to survive under various conditions would allow for prediction of high-risk situations as well as development of effective control measures. Thus, this project evaluated the ability of this yeast to survive in winery waste (e.g., pomace) over a lengthy storage time (> two years). Even after this long period of time, viable Brett could be recovered from the pomace samples.

A major vector for *B. bruxellensis* has been oak barrels. Given the porous nature of wood, the yeast can penetrate staves such that the effectiveness of methods for cleaning and sanitizing are questionable. During this project, new barrels were infected with strains of *B. bruxellensis* originally obtained from Washington wines. After a lengthy storage with wine, the barrels were drained and taken apart to determine the penetration depth of the yeast as well as impacts of such sanitizing protocols as steaming or hot water on recovery of viable cells. Results from this project have yielded suggested times/temperatures for removing the yeast from oak barrels depending on the depth of penetration (up to 8 mm).

Worldwide, some winemakers are purposefully encouraging the growth of non-Saccharomyces yeasts present on grapes to improve such sensory parameters as ‘mouthfeel.’ More recently, researchers in Australia have reported success in reducing alcohol concentrations by using sequential fermentations, that us, inoculation with selected non-*Saccharomyces* species followed by addition of *Saccharomyces*. While winemakers can rely on native yeasts to provide unique and desirable sensory qualities, there is a risk to quality if undesirable non-*Saccharomyces* yeasts dominate fermentation.

In addition, non-*Saccharomyces* are being investigated to lower final ethanol concentrations wines. Here, many of these yeasts will utilize fermentable sugars without production of ethanol thereby lessening the amount of sugar *Saccharomyces* needs to ferment to achieve dryness. Initial results indicate large reductions in ethanol being produced by additional experimentation is needed to determine overall impact of the yeasts on wine quality.

Recent Publications Related to Research:


Other Resources Available:


Research Program, con’t.

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the Wine Commission; State wine liter tax (1/4 cent per liter of all wine sold); WSU’s Agriculture Research Center; and the Auction of Washington Wines, an annual event held to raise awareness of Washington wine.

The Wine Commission dedicates about 25% of its $5 million budget to fund research projects and pay its WSU Wine Science Center pledge. Grape and wine research outcomes make significant industry impact. From vineyard water savings and reduced pesticide applications to managing wine spoilage and tannins in the winery, all involved in Washington’s wine industry benefit, from large to small growers and wineries.

To learn more about the Washington wine industry’s research program, visit: [www.washingtonwine.org/research/reports](http://www.washingtonwine.org/research/reports)
“Travel is rich with learning opportunities, and the ultimate souvenir is a broader perspective.” So says travel guru, Rick Steves, and nothing could be truer about the educational value of the tours that are available to a wide cross-section of wine industry people through our WSU V&E Program. What began in 2009 with a visit to Washington wineries around Prosser and Red Mountain, has developed into a globe-trotting learning opportunity enabling participants to learn from vintners and grape growers across four continents (so far!) – Europe, South America, Australia, and New Zealand. And the interest in these tours keeps growing.

WSU V&E Director, Thomas Henick-Kling, and Certificate Coordinator, Theresa Beaver, quickly recognized the educational benefits that participants in the local and regional trips were reaping. As Henick-Kling states, “It’s really great for winemakers and others in the industry who attend our trips to get the variety of perspectives winemakers in other regions and countries have to offer. Many of them face similar challenges that we do, but they often have different approaches to share.” Indeed, many of the travelers come back with “broadened perspectives” that increase their breadth of knowledge and practices from walking different types of terroirs from seeing sites and edifices historic to winemaking (from caves to castles), witnessing & participating in traditional processes (like treading grapes in bare feet), to experiencing the latest in new architecture, equipment, marketing, and distribution.

Surveys we have taken on the completion of each trip contain many quotes from participants attesting to the success of these learning tours. “So much was learned. One cannot substitute the educational value of walking the vineyards of history, touring the wineries, and speaking directly with the winemakers about their production techniques. For instance, walking through the caves in Spain to witness how they age the wine and manually disgorge it. Or learning how certain grape varieties have changed over the last centuries and how a one winemaker is attempting to propagate some varieties that are on the verge of being lost. This trip was of great value to me and my wine education.” (Spain trip, 2016).

Of course, all of the winery tours include delicious local foods provided by the generous hosts, as described by a participant on the Italy tour, “From the Barolos and Barbarescos of Piedmont, to the Chiantis of Tuscany, the Amarones and Valpolicellas of Veneto, we sipped lots of luscious reds paired with wonderful Italian cheeses, prosciuttos, salamis, and even chocolates that were offered… by hosts that were as generous as they were gracious, sharing information and happily answering our questions.” (Tuscany, 2014).

There is no doubt that these tours continue to achieve not only their educational goals, but they build relationships of camaraderie and goodwill across oceans and borders. If you feel inspired to join in one of our upcoming educational wine adventures, please go to our website to see what’s to come. Like, New Zealand in January 2019! Find complete information at this link: http://wine.wsu.edu/education/certificate/international-winery-tours/, or contact Theresa Beaver at tbeaver@wsu.edu. We guarantee you will have a Bon Voyage!
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