Viticulture and Enology Extension News

Washington State University

Viticulture and Enology Program

WASHINGTON STATE UNIVERSITY

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EDITOR

Michelle M. Moyer, PhD

NOTE FROM THE EDITOR

What a difference a year can make. As we wrote the Spring 2016 VEEN, vines were well past break at this time, and we were already planning for a record-early harvest. Fortunately, the off-to-the-races 2016 slowed down to only a slightly-ahead of average fall. Then winter came... and it snowed...and snowed...and got colder... and snowed some more. We were once again reminded why those not from the region refer to us as a "cold climate." While that snow disrupted travel and resulted in many kids joyously waking up early to watch the morning news, it also provided us with much-needed winter moisture, and, likely more importantly, insulation from some of the cold January temperatures we experienced.

But with the sun shinning, buds breaking, and the frantic push to finish last-minute pruning, its easy to let go of winter and start embracing the 2017 season. This Spring issue of VEEN has several articles that you will hopefully find useful for this upcoming season (with some reminders to not forget winter just yet!), as well as some highlights on recent changes seen in the industry.

Happy reading as you watch the final dregs of snow melt from the hills.

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It is also a valuable site for downloading our most recent Extension publications, in addition to archived articles and newsletters you can print on demand. Find quick links to AgWeatherNet, the Viticulture and Enology Degree and Certificate programs, as well as to other Viticulture and Enology related resources.

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Water, water, everywhere!

By Michelle Moyer and Lynn Mills, WSU-Prosser

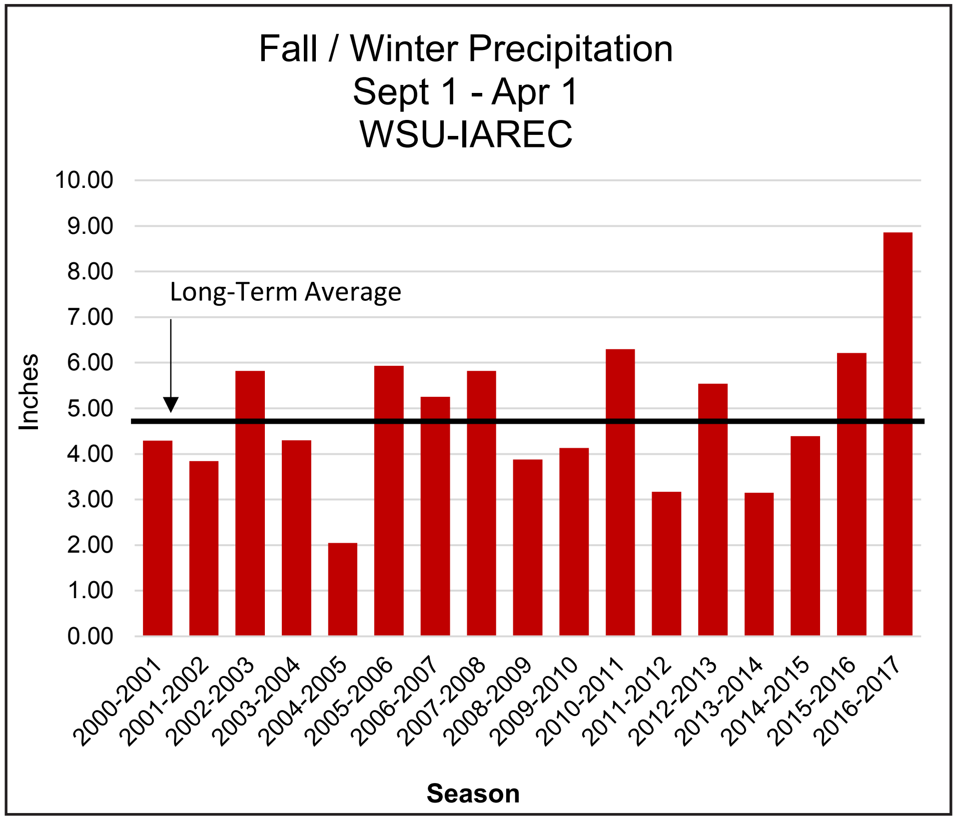

***Figure 1** - Annual winter precipitation at the WSU-HQ AgWeatherNet station from 2000-2017. The solid line represents the average winter precipitation over 17 winters.*

The 2016-2017 winter can be best described with one word: Long. An uncharacteristically extended period of snow cover, coupled with higher-than-average precipitation (**Fig. 1**), washed away recent memories of a drought-stricken hibernation. While this welcomed precipitation aided snowpack, reservoirs, and ground water, it will also bring challenges associated with rapid, early season canopy development. The two main challenges include:

1) Nutrition management in rapidly growing vines. Early in the season, the ephemeral appearance of nutrient deficiencies, particularly nitrogen, can be common as nutrients are rapidly diluted into new growing points. These short-term deficiency systems can be exacerbated with excessively rapid canopy growth, and may require additional nutrient application to alleviate severe symptoms. Be sure to watch deficiency symptoms, and intervene if they last for more than a couple of weeks.

2) Canopy collapse in response to water stress. The bigger the vine canopy, the more water it will ultimately use. This means that standard RDI practices may need to be adjusted to compensate for larger vines. Extreme water stress on large canopies may result in canopy collapse mid-summer, as the vine struggles with additional water loss from a large leaf area. While the temptation to get canopies under control by using deficit irrigation will be strong, be sure to monitor vine response to avoid crop loss or delayed ripening.

Fortunately, challenges may be alleviated by the forecast above-normal temperatures (**Fig. 2**), coupled with average precipitation (**Fig. 3**) which should help in slowing canopy development. Until then, watch your spring irrigation events, making sure you are only watering when actually needed. Remember, there is plenty of moisture in the soil now, and vine water use is relatively low.

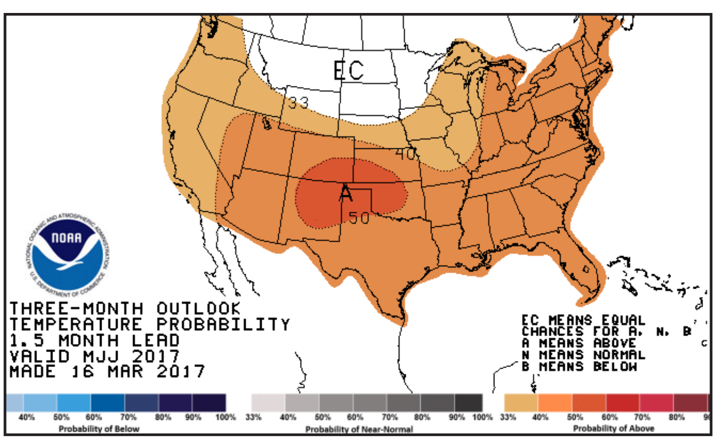

***Figure 2** - NOAA 2.5 Month Temperature Outlook (May-June-July). Temperatures are estimated to be above normal. Image from: http://www.cpc.ncep.noaa.gov/products/predictions/long_range*

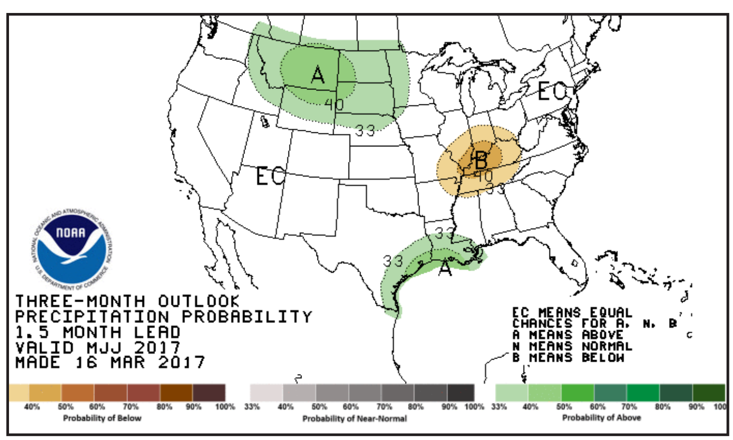

***Figure 3** - NOAA 2.5 Month Precipitation Outlook (May-June-July). Precipitation is estimated to normal. Image from: http://www.cpc.ncep.noaa.gov/products/predictions/long_range.*

Berry Splitting: More Than a Myth in Dry Climates

By Ben-Min Chang, Ph.D. Candidate, and Markus Keller, WSU-Prosser

Grape berry splitting results from the failure of the skin due to excessive tension. While splits expand on the skin, they can also extend deep into the berry flesh. Split berries expose their vulnerable flesh to the dry atmosphere and hostile pathogens.

Although splitting is much more common in humid climates, such as those of western Washington, grape berries in arid eastern Washington are not immune to splitting. Rain is one of the factors that induces berry splitting, but this is not common in an area with low rainfall during the growing season.

There are many symptoms indicating possible berry splitting events. In arid eastern Washington, the window to directly observe berry splitting is relatively short because dehydration begins almost immediately. Fast dehydration will cover the split in the wavy skin (**Fig. 1**). At this stage, careful inspections up-close are required to directly observe the split skins.

Besides shriveling, a droplet at the berry tip might also indicate berry splitting (**Fig. 2**). In this case, the splits are usually small and hard to see. However, varieties with compact clusters may accumulate enough pressure and stress to split the skin (**Fig. 3**). For example, we observed berry splitting of Chenin Blanc, Grenache, Nebbiolo, Petit Verdot, Sangiovese, Riesling, and Zinfandel on the WSU IAREC Roza farm near Prosser, WA, during the 2016 growing season. In addition, we noticed tip splitting on Barbera, Cabernet franc, Malbec, and Pinot noir. In a variety with compact clusters the consequences of berry splitting could be sour rot or bunch rot (**Fig. 3**). In this case, the splits usually are located near the pedicel and are often masked by adjacent berries.

Figure 1 *- Shriveled Concord berries have golf ball like appearances. The red arrows indicate the split that led to the shriveling.*

Figure 2 *- A Malbec berry with juice excreted from the split tip of the berry.*

Another concern related to berry splitting is water stress. Water stress and grape berry splitting seem to be two contradictory events. Imposing moderate water stress on wine grapes is a common practice to control vigor for desired berry quality. The arid climate of eastern Washington makes deficit irrigation a powerful tool to manipulate wine style. We often assume that less water supply, by limiting berry growth, should reduce the chances of berry splitting. Surprisingly, however, deficit irrigation does not prevent splitting in this region.

Recently, we have conducted studies to both determine which varieties are more resistant to berry splitting, and if there was any relationship between water stress and the likelihood of berry splitting.

As a generality, our measurements showed that the splitting resistance dropped greatly at the onset of berry softening but before any color change in the skin. Among the tested varieties, Syrah, Zinfandel, and Concord had markedly lower splitting resistance than Merlot.

In a Concord vineyard that experienced drought stress before veraison, the splitting resistance of berries from stressed vines was 13% lower than the resistance of berries from vines without water stress. As a consequence, there was 20% berry splitting in the stressed portion of the vineyard compared with only 1% in the non-stressed portion. In another irrigation study with Concord, the splitting rate was slightly higher on vines that received water at 50% of vineyard evapotranspiration (ET), but only if the water deficit was relieved at veraison. However, we did not observe a similar effect in Cabernet Sauvignon irrigated at only 25% ET before but not after veraison. In this investigation, the dual roles of water stress on berry splitting were demonstrated.

Although these results are preliminary, growers may want to be careful to tailor the severity of deficit irrigation to a variety's vulnerability to berry splitting.

Figure 3 *- A compact Zinfandel cluster with a newly split berry and Botrytis-infected berries.*

Vineyard Surveys for Potential Red Blotch Vectors

By Doug Walsh, WSU-Prosser

Grapevine viruses are most frequently vectored by humans and moved by planting infected planting material or during grafting. Unfortunately some grapevine viruses are also spread by invertebrate vectors. *Grapevine leafroll associated viruses* (GVLRaV) are spread by mealybugs and scales. *Grapevine fanleaf virus* (GFLV) and *Tomato ringspot virus* (ToRSV) are spread by certain nematode species, and *Grapevine Pinot gris virus* (GPGV) is spread by an eriophyid mite, *Colomerus vitis*.

Grapevine red blotch-associated virus (GRBaV) is a single-stranded DNA virus and a member of a new genus in the geminivirus family, Geminiviridae. GRBaV is phylogenetically close to another geminivirus, *Tomato pseudo curly top virus,* which is transmitted by a treehopper.

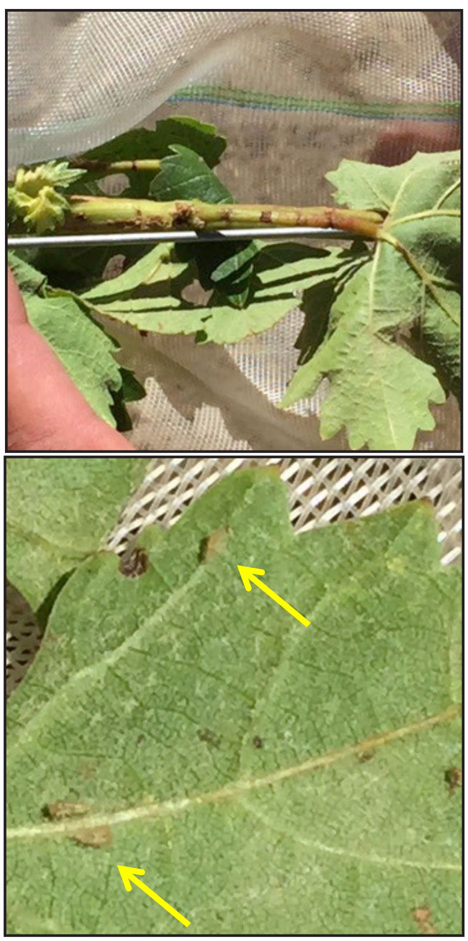

Figure 1 *- Feeding (top) and egg-laying (bottom) of* Spissistilus festinus *on grapes. Photo by Frank Zalom, UC-Davis.*

Former WSU student Brian Bahder (now an Assistant Professor of Entomology at University of Florida) demonstrated that GRBaV could be transmitted by the three-cornered alfalfa treehopper, *Spissistilus festinus* (Hemiptera: Membracidae) under both laboratory and field conditions during his postdoctoral research at University of California-Davis. Prior to its identification as a vector of GRBaV, *S. festinus* was considered a minor pest of grapevines in California and Southern Oregon, causing feeding injury resulting in girdling of shoots and petioles (**Fig. 1**).

S. festinus is a membracid, native to southern-tier US states, and is ubiquitous in California alfalfa. There are no records for *S. festinus* in Washington State. In Oregon, *S. festinus* persists in the Rogue River Valley but not in the Willamette Valley, leading researchers to postulate that *S. festinus* has a northern threshold.

In Oregon in 2015 it was observed that GRBaV was spreading in the Rogue River Valley more rapidly than in the Willamette Valley, which was consistent with the presence of the vector in the more southern region.

In late-season 2016, however, Oregon State University scientists led by entomologist Vaughn Walton observed rapid spread of GRBaV in the Willamette Valley in the absence of *S. festinus*.

Through substantive surveys in Oregon, several other species of membracids are now suspected to be potential vectors of GRBaV. These include treehopper species *Tortistilus wickhami* (**Fig. 2**) and *T. albidosparsus* (**Fig. 3**). Walton and his team have observed both *T. wickhami* and *T. albidosparsus* in both the Rouge and Willamette Valleys, with preliminary observations indicating *T. wickhami* to be the dominant species in Southern Oregon and *T. albidosparsus* the dominant species in the Willamette Valley. Simultaneously, an entomology team led by Frank Zalom at University of California Davis made similar observations in California. Unfortunately, alfalfa has been implicated as a primary host plant for both *T. wickhami* and *T. albidosparsus*.

Many grape growers in California and Oregon where GRBaV has spread rapidly speculate that the wide-scale adoption of viticultural practices involving the establishment of cover crops contributed to the rapid spread of GRBaV. Ironically, cover crops were established to enhance conservation biological control of endemic pests in vineyards. Often cover crop blends have leguminous plants in them and the legumes are likely serving as the preferred host plants in vineyards for *S. festinus.*

Concurrently the wide-scale planting of genetically engineered "Round-up Ready" (glyphosate-resistant) alfalfa has led to the increase of roadside alfalfa patches where transportation agencies are applying glyphosate and inadvertently selecting for increased persistence of glyphosate-resistant alfalfa on roadsides. A survey conducted in 2011 of roadside volunteer alfalfa in Walla Walla County indicated that over 15% of the alfalfa contained the transgene that confers glyphosate resistance. The proportion of roadside alfalfa plants with the transgene is likely even greater now.

Overcoming our complacency given the absence of *S. festinus* in Washington State, this year

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we will initiate comprehensive surveys in and near Washington State vineyards for the presence of membracids and other insects that could potentially vector GRBaV.

We are currently soliciting study sites from grape growers. We intend to visit these study sites at least every other week and sample for insects via multiple methods. Yellow sticky cards will be hung in the vineyard canopy, shake samples will be completed in the canopy, and sweep net samples will be taken from vegetation on the vineyard floor and vegetation outside the vineyard but in proximity to vineyards (emphasis will be placed on feral alfalfa). Vines will be observed for the presence of girdled twigs, as entomologists in California and Oregon have noted that this is one of the best indications that treehoppers are present in vineyards. Damage on grapevine twigs is manifested in 5 to 7 days after the feeding injury.

Concurrently, technicians from WSU-Prosser will take a series of monthly road trips to areas including Walla Walla, Chelan, Maryhill, and Wenatchee where vineyards and roadside habitats will be sampled by sweepnet and shake methods. These samples will be deposited into our portable "knock-down" chamber, where insects are anesthetized with a short burst of cold carbon dioxide (CO_2) gas for transport back to the laboratory at WSU-Prosser for identification.

This qualitative survey of insects in proximity to Washington State vineyards that could potentially vector GRBaV will provide us with the foundation for subsequent controlled greenhouse tests we will conduct with WSU virologist Naidu Rayapati to determine if specific insects that are endemic to Washington State may be capable of serving as vectors for GRBaV.

Interested in Participating?

If you are interested in participating in this study, please contact Doug Walsh at: dwalsh@ wsu.edu.

Figure 2 - T. wickhami, *mostly in Southern Oregon. Photo by Vaughn Walton, Oregon State University.*

Figure 3 - T. albidosparsus, *mostly in Willamette Valley. Photo by Vaughn Walton, Oregon State University.*

Understanding Herbicides and Resistance

By Lynn Sosnoskie, WSU-Wenatchee

Herbicides are defined as substances used to eliminate unwanted plants. Within that definition, however, we can classify herbicides in many different ways. For instance, they can be classified by when they are used (pre-emergence or post-emergence), by their mobility within the plant (contact or systemic), according to their selectivity (control of grasses or broadleaves or both), and by their site of action (SOA).

There are some distinctions between SOAs and modes of action (MOAs). The difference between MOAs and SOAs is akin to looking at the 'big picture' versus the 'details'. An MOA is how the herbicide works, (e.g., inhibits fatty acid biosynthesis) whereas a SOA is the specific cellular site/biochemical pathway that is targeted by the herbicide (e.g., acetyl CoA carboxylase). **Figure 1** depicts the MOAs that result in plant injury and death, as well as the SOAs that elicit these responses. **Table 1 (next page)** provides a list of examples describing the diversity in herbicide SOAs available for use in grapes in the Pacific Northwest.

In the following pages, a detailed description about the herbicidal activity of the available SOAs, as well as information about confirmed cases of herbicide resistance in ID, OR or WA to the class of chemicals is presented. For additional information about herbicide resistance occurring in the PNW, please see the International Survey of Herbicide Resistant Weeds.

WSSA 1: Acetyl CoA carboxylase (ACCase) inhibitors

These herbicides are primarily selective against grasses. They are foliar-applied, and are translocated to the meristem (growing point)

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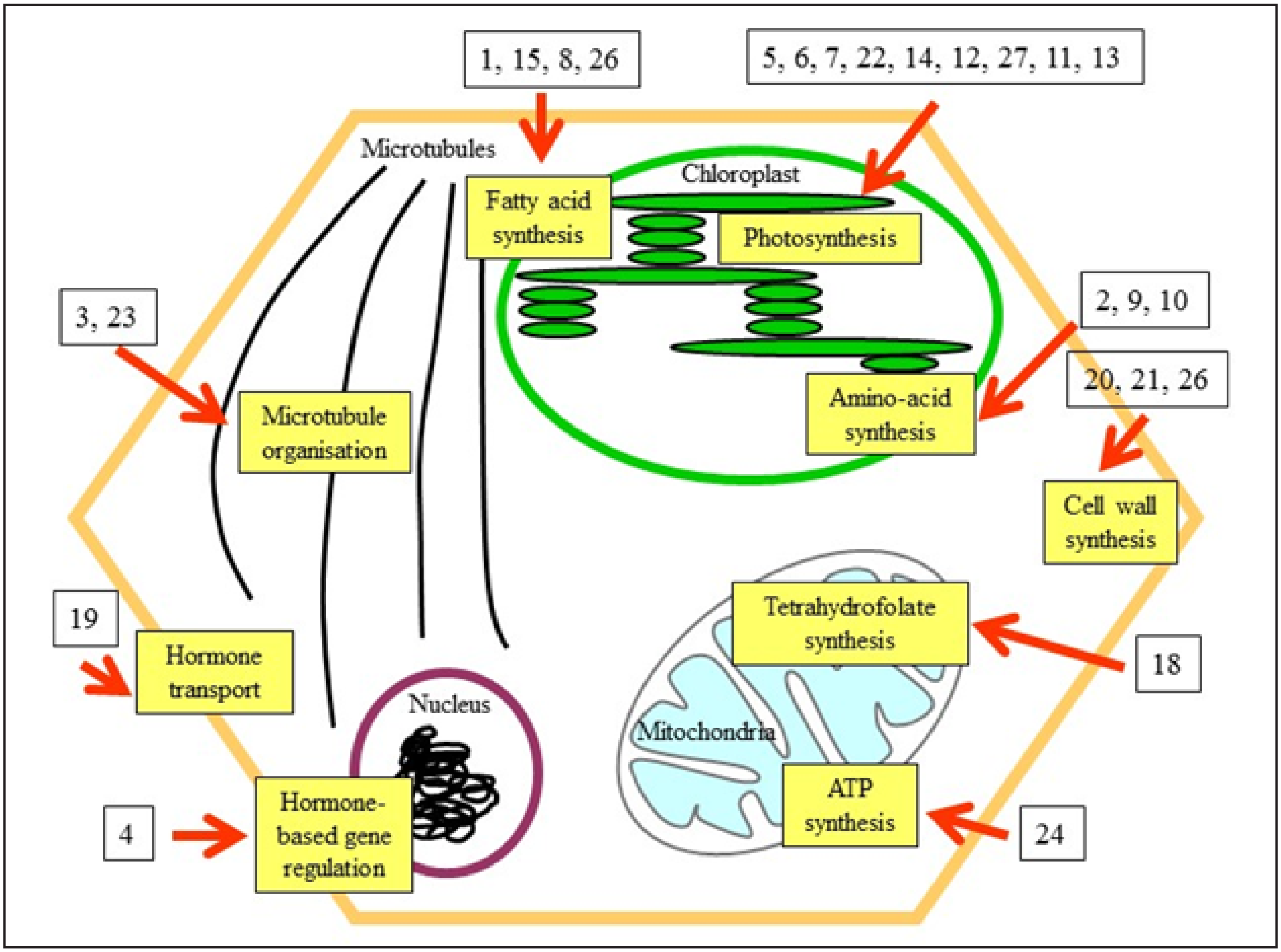

Figure 1 - General cellular processes targeted by herbicide groups. Yellow boxes describe MOAs whereas the white boxes indicate the SOAs that elicit the general responses. Herbicide numerical classification according to the Weed Science Society of America (WSSA). Figure is adapted from the original with permission: Delye et al. (2013) Trends in Genetics 29:649-658.

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where they inhibit acetyl-CoA carboxylase. This enzyme catalyses the first step in the synthesis of fatty acids which are vital components of plant cell membranes. An example of this herbicide type is: sethoxydim (Poast®). There is confirmed resistance in wild oat, cheatgrass and rigid rye.

Table 1. Herbicide SOAs available for use in grapes in the PNW according to the PNW Pest Management Handbook and the Pest Management Guide for Grapes in Washington. Herbicide numerical classification according to the Weed Science Society of America (WSSA).

WSSA Group	Site of Action (SOA)	Mode of Action (MOA)
1	Acetyl CoA carboxylase (ACCase) inhibitors	Fatty acid biosynthesis
2	Acetolactate synthase (ALS) inhibitors	Amino acid biosynthesis
3	Microtubule inhibitors	Microtubule polymerization
5	Photosystem II (PSII) inhibitors (D1 protein)	Photosynthesis
7	Photosystem II (PSII) inhibitors (D1 protein)	Photosynthesis
9	5-enolpyruvyl-shikimate synthase (EPSPS) inhibitor	Amino acid biosynthesis
10	Glutamine synthase inhibitor	Amino acid biosynthesis
12	Phytoene desaturase inhibitors	Photosynthesis
14	Protoporphyrinogen oxidase (PPO) inhibitors	Photosynthesis
15	Very long chain fatty acid (VLCHA) inhibitors	Fatty acid synthesis
20	Cellulose inhibitors	Cell wall synthesis
21	Cellulose inhibitors	Cell wall synthesis
22	Photosystem I (PSI) electron diverter	Photosynthesis

WSSA 2: Acetolactate synthase (ALS) inhibitors

These herbicides can be applied at pre-emergence and/or post-emergence. They can be absorbed by both roots and shoots and are translocated to growing points. The specific target of these herbicides is acetolactate synthase, a key enzyme involved in the production of branched chain amino acids (leucine, isoleucine, valine), which disrupts protein biosynthesis. An example of this herbicide type is rimsulfuron (Matrix® SG). There is confirmed resistance in kochia, prickly lettuce, spiny sowthistle, smallseed false flax, Russian thistle, mayweed chamomile, cheatgrass, and Italian ryegrass.

WSSA 3: Microtubule assembly inhibitors

These soil- applied herbicides are absorbed by shoots and roots, but are not readily translocated. They bind to the tubulin protein, which is needed to polymerize microtubules. Microtubules are necessary for cell division. An example of this herbicide type is pendimethalin (Prowl® H2O). There is confirmed resistance in wild oat.

WSSA 5, 7: Photosystem II (PS II) inhibitors (D1 protein)

These herbicides are primarily applied at pre-emergence, although some products have post-emergence activity. Herbicides in WSSA groups 5 and 7 bind to different sites on the D1 protein in the photosystem II complex and interfere with the transport of electrons. This inhibits photosynthesis and stops the production of energy required for growth. Ultimately, what injures the weed is the accumulation of reactive molecules that destroy proteins and lipids. An example of an herbicide in these groups is simazine (Princep® 4L). There is confirmed resistance in Powell amaranth, common groundsel, redroot pigweed, common lambsquarters, annual bluegrass, and shepherd's purse.

WSSA 9: 5-enolpyruvyl-shikimate synthase (EPSPS) inhibitors

This herbicide group is defined by the active ingredient glyphosate, better known by its most common trade name: Roundup® (among others). Glyphosate is a foliar-applied product that is translocated to plant meristems where it inhibits 5-enolpyruvyl-shikimate synthase, a key enzyme in the shikimic acid pathway. The shikimic acid pathway is involved in the synthesis of aromatic amino acids (tyrosine, tryptophan, phenylalanine); disruption inhibits the production of proteins. There is confirmed resistance in kochia, Italian ryegrass, and Russian thistle.

WSSA 10: Glutamine synthase inhibitors

These are post-emergence herbicides. They inhibit glutamine synthase, the enzyme that converts ammonia to glutamine. Inhibition results in ammonia accumulation, which inhibits both PS I and II reactions. An example of an herbicide in this group is: glufosinate (Rely® 280). There is confirmed resistance in Italian ryegrass.

WSSA 12: Phytoene desaturase inhibitors

These are pre-emergence herbicides in vineyards. The active ingredients block phytoene desaturase, an enzyme involved in the biosynthesis of carotenoids (a class of predominantly yellow, orange, or red pigments). Carotenoids are necessary for protecting chloroplasts, which is

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where photosynthesis occurs. An example of an herbicide in this group is norflurazon (Solicam®). There is confirmed resistance in annual bluegrass.

WSSA 14: Protoporphyrinogen oxidase (PPO) inhibitors

These herbicides can have pre- or post-emergence activity. They inhibit the protoporphyrinogen oxidase (PPO) enzyme involved in chlorophyll (needed for photosynthesis) and heme (needed for electron transfer chains) biosynthesis. Injury to the weed is primarily due to the accumulation of reactive molecules that build up and destroy plant cell membranes. An example of an herbicide in this group is flumioxazin (Chateau®). There is no confirmed resistance in weeds in the PNW to this group .

WSSA 15: Very long chain fatty acid (VLCFA) inhibitors

These soil-applied herbicides are absorbed through roots and emerging shoots. They inhibit the biosynthesis of VLCFAs, although the specific target sites are still being explored. VLCFAs are components or precursors of plant cell membranes and the cuticle; as a consequence, plant cell division is inhibited. An example of an herbicide in this group is napropamide (Devrinol®). There is no confirmed resistance in weeds in the PNW to this group.

WSSA 20, 21: Cellulose inhibitors

These soil-applied herbicides inhibit the biosynthesis of cellulose which is a structural carbohydrate found in the plant cell wall. Ultimately, cell wall division is impeded. An example of an herbicide in this group is indaziflam (Alion®). There is no confirmed resistance in weeds in the PNW to this group.

WSSA 22: Photosystem I (PS I) inhibitors

These post-emergence herbicides are non-translocated and light activated. Herbicides in this group destroy chlorophyll and plant cell membranes. An example of an herbicide in this group is paraquat (Gramoxone Inteon®). There is no confirmed resistance in weeds in the PNW to this group.

Concluding Remarks

The over-reliance on one SOA for weed control in an agricultural system can increase the probability of herbicide resistance. With repeated applications, susceptible individuals of a target weed species will die off while the numbers of resistant plants will continue to grow. With time, the herbicide or herbicide group will no longer control that species in that location. The chances of the population reverting to a susceptible state are low.

To prevent/mitigate herbicide resistance, rotate herbicide SOAs to reduce the selective pressure applied by any one product. Of course, rotating chemicals is only one component of a weed/herbicide resistance management program. Other techniques include (but are not limited to): cultivating, hand-weeding, mulching or inter-cropping, preventing weeds from going to seed, and preventing weed seed from being dispersed on farm equipment. Equally important is scouting, to get an understanding of weed populations both BEFORE and AFTER weed control strategies are employed. This will allow you to detect potentially resistant populations early and manage them effectively.

Understanding how herbicides act within plants (and what symptoms they elicit) can also help with the diagnosis of off-target herbicide injury. Different herbicide groups may elicit different injury symptoms, which can aid in trouble-shooting. For information about herbicide injury, please see the University of California IPM herbicide symptoms webpage or the North Carolina State University herbicide injury factsheets. Information on herbicide injury symptoms is also presented in the *Field Guide for Integrated Pest Management in Pacific Northwest Vineyards* (PNW644).

Information Resources

- Delye et al. (2013) Trends in Genetics 29:649-658: http://www.cell.com/trends/genetics/abstract/S0168-9525(13)00090-5
- International survey of herbicide resistant weeds: http://weedscience.org/
- North Carolina State University herbicide injury factsheets: https://content.ces.ncsu.edu/catalog/series/184/herbicide-injury
- University of California IPM herbicide symptoms webpage: http://herbicidesymptoms.ipm.ucanr.edu/
- Weed Science Society of America herbicide classifications: http://wssa.net/wp-content/uploads/WSSA-Mechanism-of-Action.pdf

Predicting Phenology: A New Tool from AgWeatherNet

By Melba Salazar-Gutiérrez, WSU-AgWeatherNet

Phenology refers to "the science of appearance". This translates into understanding nature's "calendar" of plant development. Important phenological events in viticulture include bud break, bloom and veraison, which are tied closely with management practices.

Predicting when these events will occur can be difficult; most key phenological stages of grape are sensitive to climate and seasonal weather. Seasonal changes can include variations in day length, temperature, and precipitation. Adding to the challenge is that spring phenological events are occurring earlier and fall events are happening later than they have in the past as a result of climate variability.

Fortunately, most phenological events are in response to air and/or soil temperature changes, meaning that they could, in theory, be modeled. The accumulation of a specific amount of heat (termed "heat units") typically trigger these events, and each phenological stage has its own heat accumulation threshold (termed "degree days").

Knowing when certain phenological stages occur can help with planning vineyard activities, including pruning, shoot thinning, and pest management. AgWeatherNet is introducing a phenology prediction tool for grape growers. This tool was developed with funding support by the Washington State Grape and Wine Research Program.

The phenology prediction tool is based on growing degree days for bud break, full bloom and veraison. It allows users to track both the appearance and duration of these stages for 17 cultivars during the season and compare with previous seasons. The model is accessible on all AgWeatherNet Stations. A user account is needed to access the tool; obtaining an account is free.

Users can access this tool under the "Crop Models" at the AgWeatherNet website (http://weather.wsu.edu). It is called "Grape Stages". A screencapture of the phenological tool output is seen in **Fig. 1**.

This new tool is still in its preliminary phase, and the AgWeatherNet team is asking for your feedback. Specifically, AgWeatherNet is looking for information relating to how closely the phenological times predicted by the tool match what is observed at the site. This information will be used to help improve the tool output.

If you are interested in helping with tool improvement, please contact AgWeatherNet at: weather@wsu.edu.

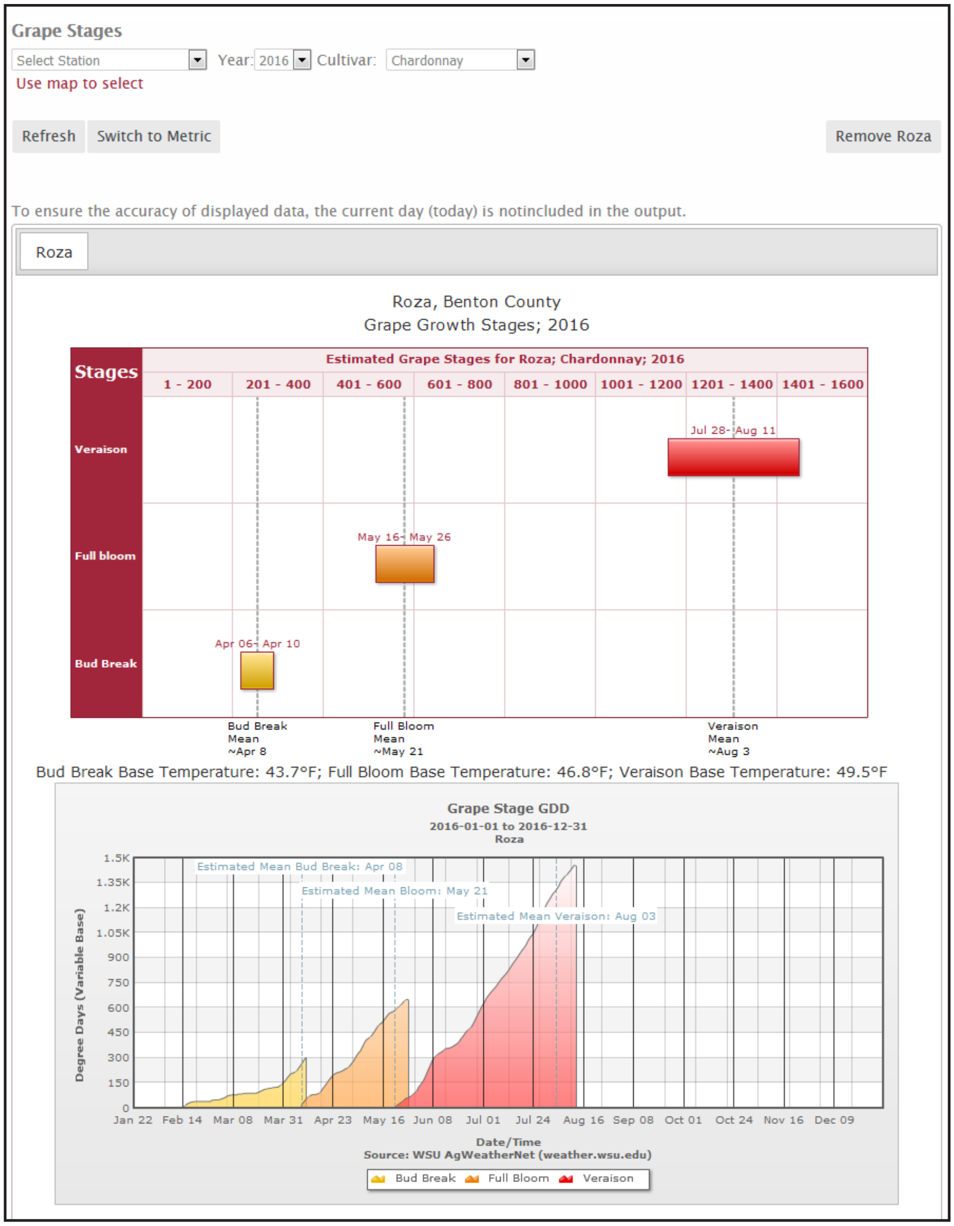

***Figure 1**- A screencapture of the grapevine phenology tool available on AgWeatherNet. The tool allows you to estimate the timing of key phenological times of 17 varieties at all of the AgWeatherNet station locations using local temperature data.*

Wine Microbiology Lab Updates

By Charlie Edwards, WSU-Pullman

Our laboratory continues to study two very important issues to Washington wineries; *Brettanomyces* infections and non-*Saccharomyces* yeasts. Specifically, our work focus on (1) survivability of *B. bruxellensis* in winery waste such as grape pomace, (2) yeast penetration of different types of oak staves, and (3) potential commercial utilization of non-*Saccharomyces* yeasts isolated from Washington grapes.

Brettanomyces survival in winery waste such as pomace is currently being investigated by Zach Cartwright (Ph.D. student). *B. bruxellensis* could be recovered from Syrah grape pomace stored in two different vineyards even after 100 weeks of incubation. While these two vineyards are located in the Columbia Valley AVA, a third was added from the Walla Walla AVA in 2016. Overall, seasonal variation with better growth in spring and summer months were noted. Better recovery was noted in those pomace samples previously sterilized using gamma irradiation indicating that this yeast is a poor competitor when other microbes are present.

In addition to pomace work, Zach is also investigating methods to reduce populations of *Brettanomyces* in barrels. After disassembling 16-L oak barrels inoculated with *B. bruxellensis*, the yeast was found to penetrate the furthest in light or heavy-toasted French oak staves located at the bottom of barrels (5 to 9 mm from inside of barrel) compared to those prepared from American oak (0 to 4 mm).

Thermocouple data indicated that a range of 3 to 4 minutes was required for stave layers <9 mm to reach 55°C, a temperature which *B. bruxellensis* is thought to have a D-value of approximately 1 min (D-value is the time at a specific temperature for a microbe to reduce its population by 90%). Steaming staves for 6 to 9 min resulted in no recovery of *B. bruxellensis* from the 0 to 4 mm layer while an additional 3 to 6 min was needed to not recover cells from the 5 to 9 mm layer. Based on these results, steaming times of at least 12 minutes are needed to remove *B. bruxellensis* if yeasts are present in staves at depths of <9 mm.

Current research on non-*Saccharomyces* is being led by Jesse Aplin (Ph.D. student). He is examining the ability of these yeasts to reduce potential alcohol in wines, as well as overall impacts on wine quality. Initial inoculation of non-*Saccharomyces* yeasts followed by *S. cerevisiae* significantly ($p \leq 0.05$) reduced ethanol content compared to those produced by *S. cerevisiae* alone. Here, *Mt. pulcherrima* P01A016 achieved the greatest reduction, producing 11.7% v/v compared to 13.7% v/v by wines fermented only by *S. cerevisiae*. Ferments inoculated with *My. guillermondii* P40D002, *Mt. pulcherrima*, and *Mt. fructicola* reduced ethanol to yielded 12.1% to 12.27% v/v while *P. membranifaciens, P. kluyveri, Mt. chrysoperlae,* or *T. delbrueckii* strain reduced alcohol to 13.0 to 13.4% v/v.

All yeast strains tested produced acetic acid at levels below the sensory threshold of 0.7 g/L, although higher levels were noted for *Mt. chrysoperlae, T. delbrueckii* and *S. cerevisiae.* Based on reduced ethanol and acetic acid production, native strains *Mt. pulcherrima* P01A016 and *My. guillermondii* P40D002, as well as the industrial *Mt. pulcherrima* strain, were selected for further winemaking trials. Finally, several non-*Saccharomyces* species exhibited pectinase activity under a range of screening protocols. Of these, *Cr. adeliensis, I. orientalis,* and *P. kluyveri*, were chosen for winemaking trials including the determination of sensory impacts such as mouthfeel.

Other ongoing research projects in our laboratory include impacts of *Pediococcus* spp. on wine quality (Megan Wade, M.S. student), problems with alcoholic fermentation of peary/ciders (Robert Beezer), and use of *Lactobacillus plantarum* as an alternative bacterium to induce malolactic fermentation (Curtis Merrick).

Recent Publications Related to Research:

Petrova, B., Z.M. Cartwright, and C.G. Edwards. 2016. Effectiveness of chitosan preparations against Brettanomyces bruxellensis grown in culture media and red wines. J. Int. Sci. Vigne Vin. 50: 49-57.

Strickland, M.T., L.M. Scopp, C.G. Edwards, and J.P. Osborne. 2016. Effect of Pediococcus spp. on the chemical and sensory properties of Pinot noir wine. Am. J. Enol. Vitic. 67: 188-198.

Von Cosmos, N., and C.G. Edwards. 2016. Use of nutritional requirements for Brettanomyces bruxellensis to limit infections in wine. Fermentation 2: 17; doi:10.3390/fermentation2030017

Oswald, T. and C.G. Edwards. 2017. Interactions between storage temperature and ethanol that affect growth of Brettanomyces bruxellensis in Merlot wine. Am. J. Enol Vitic. (accepted, 2017).

New Name and Logo for WA Wine Industry Group

Press Release, Washington Winegrowers Association

The Washington Association of Wine Grape Growers (WAWGG) unveiled a new identity during their annual meeting held at the 2017 Convention and Trade Show in Kennewick, WA. The organization rebranded as the Washington Winegrowers Association or Washington Winegrowers for short.

The change is part of a comprehensive brand evolution process with a new name, tagline and logo all mission-driven. According to Todd Newhouse, Board Chair, "Our aim is to enhance industry performance. Our new name and logo is just part of a larger journey to become even more mission-driven in everything we do, to help members and the broader industry." The process began nearly two years ago with the board of directors looking to meet the demands of a growing industry.

The name "winegrowers" has been used as verbal shorthand for the longer, former name (Washington Association of Wine Grape Growers) with the term being used to describe a person who owns a vineyard and makes wine.

"Many members who once only grew grapes now have both vineyards and wineries," commented Vicky Scharlau, Executive Director of Washington Winegrowers. "People from all over the country are taking notice of Washington State and investment in infrastructure from both the supply-side and production-side has exponentially expanded. Our new name and logo is reflective of the industry growth."

For over 30 years, the Washington Winegrowers have served the unique and shared interests of those who produce wine and grow wine grapes. The name change is the public acknowledgement of an intention to further the vision of a thriving industry—recognized globally—for quality wines and vineyards, supported by exceptional education and leading edge research.

WASHINGTON WINEGROWERS™

ADVANCING OUR INDUSTRY

Additional initiatives are underway to better serve and engage members and the broader industry including a revamped website and other communication tools.

For more information, visit WAwinegrowers.org

Contact Information:

Washington Winegrowers Association (Formerly WAWGG):

Vicky Scharlau
Executive Director
509-782-8234 / vicky@wawgg.org
WAwinegrowers.org

About Washington Winegrowers Association:

Established in 1984, the Washington Winegrowers (formerly, Washington Association of Wine Grape Growers) serves the industry as a synergistic leader—through advocacy and education—for growers, vintners, partners and policymakers. For growers and vintners who want to optimize their business, Washington Winegrowers is the statewide association with the strength and capability to effectively deliver consistent advocacy, education and connectivity. As a unifying voice, Washington Winegrowers uniquely provides comprehensive business solutions for the industry.

WA State's Wine Research Program Leaps Forward

By Melissa Hansen, Research Program Manager, Washington State Wine Commission

Washington State's wine research program will award more than $1 million in research grants for 2017-18, the largest amount in the program's history. The increased grant awards, up 20 percent from last year's $870,000, reflects the wine industry's growing commitment to research and a significant boost in support from the Auction of Washington Wines.

The Washington State Wine Commission approved the FY 2018 research funding recommendation put forth by its subcommittee, the Wine Research Advisory Committee, to award 18 viticulture and enology projects totaling $1,053,000.

The projects were submitted to the Washington State Grape and Wine Research Program, a competitive grant program administered by Washington State University. The program combines industry, private and public funding and support from the Wine Commission, Auction of Washington Wines, WSU's Agriculture Research Center, and state taxes collected on all wines sold in Washington (1/4 cent per liter).

The Auction of Washington Wines' contribution this year of $278,000—nearly $80,000 more than last year's donation—was a big lift to the program. Over the last decade, the Auction has donated more than $2.4 million to WSU's Viticulture and Enology Program.

The Wine Commission stepped up its research support due to the increased winery and vineyard assessments collected from the large 2016 harvest, and the state wine tax revenue dedicated to research also was up in comparison to the previous year.

Past research outcomes have benefited grape growers and wineries of all sizes throughout the state and provided economic value through various means, including irrigation water conservation; reduced pesticide usage; and most importantly, improved wine quality. WSU and industry officials estimated that, based on current acreage, an innovative spray technology widely adopted by growers that was developed by WSU to control cutworms, annually saves the industry $35 million in reduced pesticide costs, improved worker safety, and improved yields.

To learn more about viticulture and enology research, visit: www.washingtonwine.org/research/reports .

2017-18 Washington State Grape and Wine Research Program Funded Projects

WSU Researcher	Project Title*
Collins, Tom	Assessing Smoke Taint Risk Based on Composition of Smoke Exposed Grapes and the Resulting Wine
Davenport, Joan	Assessing and Ameliorating Salinity and Sodicity in Eastern WA wine Grape Vineyards
Edwards, Charles	Microbiology and Chemistry of WA Wines
Harbertson, Jim	Management of Phenolic Compounds in Vineyard and Winery, Mechanical Pruning, and Grape Maturity
Hoheisel, Gwen	Assessment of Application Technologies in Wine Grapes
Jacoby, Pete	Effects of Low Volume Root Zone Deficit Irrigation on Cabernet Sauvignon Grape and Wine Quality
James, David	**New Mites in WA Grapes: Distribution, Abundance and Significance**
Keller, Markus	Influence of Cultivar, Environment and Management on Grape Yield Components and Quality
Moyer, Michelle	**Impact and Management of Plant-Parasitic Nematodes in Washington Wine Grape Vineyards**
Moyer, Michelle	**Monitoring and Mapping Grape Powdery Mildew Fungicide Resistance and Crown Gall Incidence**
Okubara, Pat (USDA)	Characterization of Indigenous Yeasts Associated with Wine Grapes and Early State Fermentation
Piao, Hailan	**Impact of pH on Wine Microbial Ecology and Wine Quality**
Rayapati, Naidu	**Epidemiology and Management of Viral Diseases in WA Vineyards**
Ross, Carolyn	**Sensory Characteristics and Consumer Acceptance of WA Wines**
Salazar, Melba	**Influence of Climate Variability on Grapevine Phenology**
Sosnoskie, Lynn	**Weed Management in WA Wine Grapes: Current Standing and Future**
Walsh, Doug	**Qualitative Survey of WA Vineyards for Potential Insect Vectors of GV Red Blotch Virus**
Walsh, Doug	Quantifying Grape Mealybug's Efficiency as a Vector of Grapevine Leafroll Associated Viruses

* Bold denotes new project.

Census Of Agriculture Countdown Begins

By Sue King and Teresa White, USDA-NASS

America's farmers and ranchers will soon have the opportunity to strongly represent agriculture in their communities and industry by taking part in the 2017 Census of Agriculture. Conducted every five years by the U.S. Department of Agriculture's (USDA) National Agricultural Statistics Service (NASS), the census, to be mailed at the end of this year, is a complete count of all U.S. farms, ranches, and those who operate them.

"The Census of Agriculture remains the only source of uniform, comprehensive, and impartial agriculture data for every county in the nation," said NASS Administrator Hubert Hamer. "As such, census results are relied upon heavily by those who serve farmers and rural communities, including federal, state and local governments, agribusinesses, trade associations, extension educators, researchers, and farmers and ranchers themselves."

The Census of Agriculture highlights land use and ownership, operator characteristics, production practices, income and expenditures, and other topics. The 2012 Census of Agriculture revealed that over three million farmers operated more than two million farms, spanning over 914 million acres. This was a four percent decrease in the number of U.S. farms from the previous census in 2007. However, agriculture sales, income, and expenses increased between 2007 and 2012. This telling information and thousands of other agriculture statistics are a direct result of responses to the Census of Agriculture.

"Today, when data are so important, there is strength in numbers," said Hamer. "For farmers and ranchers, participation in the 2017 Census of Agriculture is their voice, their future, and their opportunity to shape American agriculture – its policies, services, and assistance programs – for years to come."

Producers who are new to farming or did not receive a Census of Agriculture in 2012 still have time to sign up to receive the 2017 Census of Agriculture report form by visiting www.agcensus.usda.gov and clicking on the 'Make Sure You Are Counted' button through June. NASS defines a farm as any place from which $1,000 or more of agricultural products were produced and sold, or normally would have been sold, during the census year (2017).

For more information about the 2017 Census of Agriculture and to see how census data are used, visit www.agcensus.usda.gov or call (800) 727-9540

Take Precautions To Avoid Pesticide Drift

By WSDA Pesticide Compliance Services

Every spring pesticide drift incidents affect workers and neighbors in tree fruit growing areas. We are reaching out to you, as a licensed Private Applicator, to seek your help in preventing pesticide drift.

We urge all applicators to follow all pesticide label instructions carefully and in ways that prevent off-target drift to workers, neighbors, or sensitive sites. To ensure pesticides do not drift beyond the intended treatment area, follow these practices:

- Read the label on the pesticides being applied and follow all precautions and restrictions for safe handling, necessary protective equipment, buffers, the effect on crops and more. Be especially diligent near sensitive areas such as highways, homes, schools and other occupied dwellings.
- Properly calibrate equipment according to tree size, shape and time of year. Use proper nozzles, nozzle configuration, proper air and water volumes and pressure to keep the spray on-target.
- Evaluate conditions such as wind speed, wind direction, and temperature. Remember that dead calm conditions when there is no air movement (inversion conditions) is an especially bad time to spray.
- Turn off outward-pointing nozzles at row ends and outer rows during airblast applications.
- Do not direct the spray above trees or vines during airblast applications (limit the plume).
- Stop applying if conditions change in ways that increase the risk of drift or if anyone approaches the area without proper protection. Within the farm's property boundaries, no one except properly trained and equipped handlers can be in the application exclusion zone (100 feet for airblast applications) during the application.

Though not currently required by law, an additional step has proven to be very helpful in preventing exposure incidents; Before making an application, communicate your spray plans to neighboring farms and scout the areas bordering the target site for unprotected workers or other persons.

Thank you for your attention to following these steps to help prevent pesticide drift.

Viticulture and Enology Extension News

http://wine.wsu.edu/research-extension

NOT RECEIVING WSU V&E EXTENSION EMAILS?

Go to our website: 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).