## A Welcome Back to Vit Tips

The continued pandemic and personnel changes knocked VitTips off its track in 2021. But with new hires and a better outlook, we are re-energized and ready to get VitTips back on track. Speaking of new personnel since the last edition of VitTips we have hired three new Viticulture Advisors in the San Joaquin Valley. Tian Tian started as the Kern County Viticulture Advisor in January 2021, Joy Hollingsworth started as the Tulare and Kings Counties Table Grape Advisor in May of 2022, and Justin Tanner started as the San Joaquin, Stanislaus, and Southern Sacramento Counties Viticulture Advisor in January of 2023. A full biography of Justin will be coming in the next edition of VitTips. However, if you can't wait that long you can reach him at his office in Stockton, CA at (209) 953-6119 or by email at jdtanner@ucanr.

### Tian Tian Continues as Viticulture Advisor for Kern County

Tian Tian became interested in grape and wine production after visiting a winery with her family in high school. She continued that journey when in 2008 she started her bachelor's degree at Northwest Agriculture and Forestry University in China. Her desire during those early years was to explore the origins of the differences between grape and wine quality. Thus, after obtaining her bachelor's degree in 2012, Tian began a master's program of study in viticulture and enology at California State University, Fresno. Her thesis research was conducted with Dr. Sanliang Gu in the Fresno area. The work showed that shifting fruit ripening from the hot summer to the cool autumn, using a technique called crop forcing, could increase phenolic accumulation in berries and improve fruit quality of red wine grapes grown in warm regions. Through her master's studies, Tian gained insights into grape production in the San Joaquin Valley, as well as realized the importance of having hands-on experiences in a production setting.

After obtaining her master's degree, she worked as a viticulture research intern at E & J Gallo Winery in Modesto, CA, and then as an assistant vineyard manager at Berryessa Gap Vineyard in Winters, CA. Tian enjoyed interacting with growers and solving practical problems in the vineyard, and this experience inspired her to pursue a career in viticulture extension. Acknowledging this newfound inspiration, Tian began her Ph.D. studies at Oregon State University, where she majored in Horticulture. With the guidance of Dr. Paul Schreiner, her dissertation work was focused on improving vine productivity and wine quality through proper nitrogen management in the vineyard and winery. She was also fascinated by the interaction between soil microbes and grapevine roots. Thus, she conducted trials to understand how roots and arbuscular mycorrhizal fungi respond to nitrogen fertilization.

After receiving her Ph.D. degree, Tian moved to Bakersfield and started her position as the viticulture farm advisor for Kern County in January 2021. Tian can be reached via email at titian@ucanr.edu, by phone at 661-868-6226, or at her office located at 1031 South Mount Vernon Avenue, Bakersfield, CA.

## Joy Hollingsworth Begins as New Table Grape Advisor for Tulare and Kings Counties

Joy Hollingsworth is the new Table Grape Advisor for the University of California Cooperative Extension serving Tulare and Kings Counties, succeeding Gabriel Torres. Joy is a Kingsburg native whose interest in agriculture started when she joined her local FFA chapter in high school. She earned a bachelor's degree in Communication from UC Davis and a master's degree in Plant Science from Fresno State. She has experience across a wide range of the agriculture sector. This includes work with Bayer CropScience, Pioneer Hi-Bred, and Dow AgroSciences, as well as non-profits such as the National Center for Appropriate Technology (NCAT) and the Community Alliance with Family Farmers (CAFF). After her time at Fresno State, Joy spent six years as a research associate, first at UC Davis, then at the Kearney Agricultural Research and Extension Center in Parlier. Her work focused on agronomic cropping systems, including sugar beets, canola, and sorghum.

Most recently, Joy spent three years as the UCCE Nutrient Management and Soil Quality Advisor for Fresno, Madera, Kings, and Tulare Counties. In that position, she conducted research and extension projects in a variety of agricultural systems. This included work characterizing dairy manure, studying cover crops, and looking into the use of biostimulants in raisin grapes. Her wide agricultural background will help her in this new role, and she looks forward to working with growers, consultants, and allied industries to help them address the challenges facing viticulture in the San Joaquin Valley.

Joy will be working closely with the other grape advisors and specialists in the area, as well as the California Table Grape Commission to develop her research and extension program. She welcomes any input or suggestions and can be reached by phone at (559) 684-3313 or by email at joyhollingsworth@ucanr.edu.

**After A Wet Winter: What You Should Do and Shouldn't Do**

**George Zhuang, UCCE, and Matthew Fidelibus, UC Davis**

Atmospheric rivers were in the headlines recently. There have been reports of flooding on farm or ag land after the winter storms, and we have had an excessive amount of rain this winter. But how much precipitation have we had since the start of the water year? Many weather stations, such as CIMIS and UC IPM, can provide the precipitation amount, and you can choose the closest station to provide the most accurate number to your farm. For myself, I used the CIMIS station at Fresno State (#80) to assess the winter rain and there have been 16.91 inches as of March 10th since October 1st of 2022. With a historical average of 10 inches on the east side of San Joaquin Valley (SJV), we will most likely double the historical amount since as the writing another atmospheric river arrived on March 10th. So, we can officially call 2023 a wet year.

Recently, I received a call from a grower asking me about what they should do after so much rain. It was an interesting question as we have started to treat drought as the new "normal". After nearly 200% historical precipitation amount, it might be a good time to review what you should and should not do after several atmospheric river events have added a large amount of rain and moisture to the SJV vineyards.

1. **Check Soil Moisture**

When you have abundant rain like this winter, you expect your soil moisture profile will be recharged. This moisture will help protect your vines from temperatures just below freezing, as well as support budbreak and strong early canopy growth. This is the reason during dry winters growers are encouraged to apply post-harvest irrigation, as well as winter irrigation to maintain a certain level of soil moisture

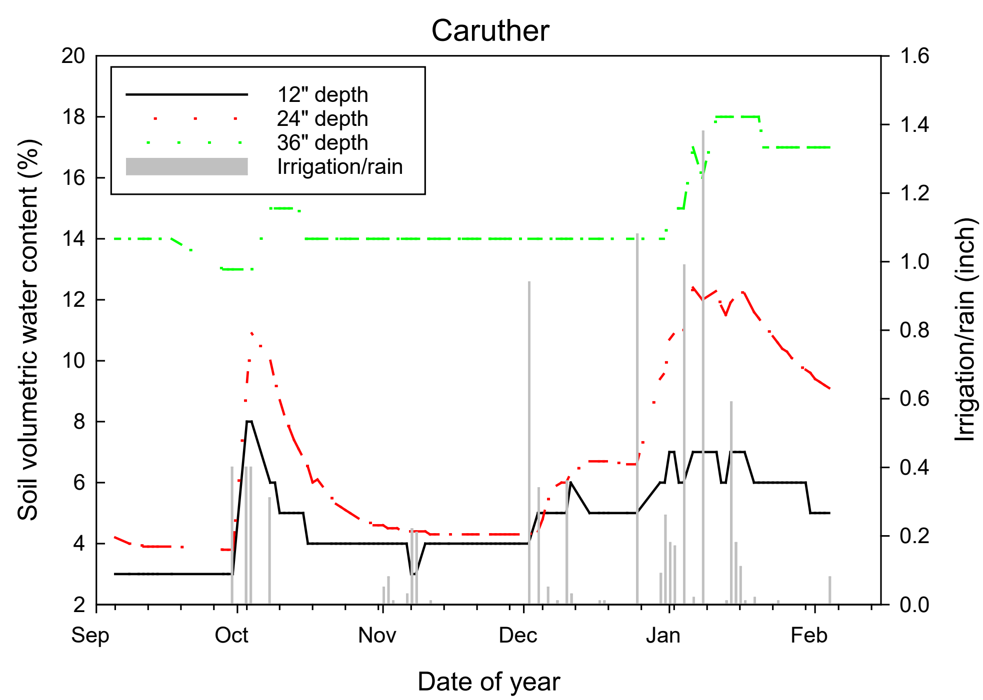


Chart 1. Soil moisture content (water volumetric content measured as %) at soil depth of 12", 24" and 36" along with precipitation and irrigation amount from September 2022 to February 2023 at UC IPM Caruthers weather station.

during the dormant season. Currently, NRCS and Fresno/Madera irrigation districts even incentivize the growers to take flood water to apply on-farm groundwater recharge, which will not only benefit the soil moisture profile, and prevent possible flooding but also help with groundwater recharge. So how do you know if your soil profile is full? A soil moisture probe or a shovel will be useful to do that. You can use soil moisture either measured by content (%) or tension (centibar) to see the soil moisture increase or decrease by irrigation or rain event. You can certainly use a shovel to dig out a soil hole to feel the moisture by hand.

Chart 1 shows the data from a soil moisture probe at the Caruthers UC IPM weather station. In October multiple post-harvest irrigation events can be seen, as well as the resulting change in soil moisture at the 12”, 24”, and 36” depths. The precipitation events in December and January can also be seen really driving up the soil moisture at 12” and 24” depths. However, it is only the January rain events that really filled up the deeper 36” soil moisture. In summary, the rain events in December and January were beneficial to recharge the soil moisture profile that will protect the vines from freezing damage as well as provide the water for early canopy growth. Growers should check the soil moisture on site and make the irrigation scheduling based on that.

## 2. Check Soil Chemistry

Major rain events are also good for leaching soil salinity and other soil issues out of the root zone. This makes it a good time to check the soil chemistry to understand how much leaching has been done from

Table 1. Guidelines for interpreting lab analysis on suitability of soil for vineyards.

| Problem and unit of measurements | No problem (<10% yield loss) * | Increasing problem (10 to 25% yield loss) | Severe problem (25 to 50% yield loss) |
|---|---|---|---|
| Salinity EC (dS/m) | 1.5 - 2.5 | 2.5 - 4.0 | 4.0 - 7.0 |
| Permeability ESP (est) | <10 | 10 - 15 | >15 |
| Sodium (meq/L) | - | >30 | - |
| Sodium (ppm) | - | >690 | - |
| Chloride (meq/L) | <10 | 10 - 30 | >30 |
| Chloride (ppm) | <350 | 350 - 1,060 | >1,060 |
| Boron (ppm) | <1 | 1 - 3 | >3 |
| pH | 5.5 - 8.5 | - | - |

*Note: Guidelines are flexible and should be modified by rootstock choices, local practices, experience, special conditions and method of irrigation. Interpretations are based on chemical analysis of the soil saturation extracts from soil samples representing the top 2 to 3 feet of soil.

all the winter storms. To do so take a composite soil sample from 2-3 locations below the drip system and blend the samples at each depth together separately. Samples should be divided by depth with each representing 1 foot of the soil profile. The top samples should be from 2” to 12”, the next should be 12” to 24”, the following from 24” to 36”, and lastly from 36” to 48”. Store the soil samples in the cooler before sending the samples to the commercial lab. Soil pH, electrical conductivity (EC), Sodium (Na), Chloride (Cl-), and Boron (B) are the main targets of soil analysis. If leaching has been successful, you should find that the salts were pushed from the top to the deeper soil, e.g., from the 2” to 12” sample down towards the 36” to 48” sample. The idea of leaching is to push the excessive salts below the root zone, which covers approximately the top 3 feet of the soil profile. This is because most grapevine roots stay in the top 3 feet of soil. The optimal soil chemistry range for a grapevine can be found in Table 1.

## 3. Holding Irrigation to Save Water and Energy Costs

When to start irrigation is a yearly question to be asked when managing a vineyard. With the December and January rain events affecting soil moisture down past 36” (chart 1), we are starting the 2023 growing season with full field capacity. But how fast is water in the soil profile depleted? It will vary depending on your vineyard and how the remainder of the rain season develops. According to Dr. Larry Williams, at field capacity, SJV growers probably can start the first irrigation in mid-May or bloom. Irrigating the vines before they need irrigation will waste water and increase your energy bill from pumping that water. The decision to start irrigation should rely on at least one of the following: soil moisture; plant water stress; and visual assessment of the grapevine. I often recommend growers use soil moisture and visual assessment of the grapevines to trigger the first irrigation event. This is because plant water stress measurements are usually expensive and labor-intensive for SJV grape growing. The use of soil moisture data such as those seen in Chart 1. Growers will need to set up a threshold at a certain soil depth to start the irrigation, and I prefer to use the soil moisture at 24” since it will give the soil moisture indicator from neither shallow nor deep soil. For the majority of SJV vineyards with sandy loam soil, soil moisture at 24” ranging from 10-15% might serve as the threshold. However, growers cannot solely rely on soil moisture to guide their irrigation events. This is because measuring soil moisture in only one or two locations will not give a grower the full picture of the entire vineyard’s soil moisture profile. Visual assessment can really serve as a confirmation in addition to your soil moisture data. Looking at the tendrils and shoot tips (Photo 1) will give you an indication if there is any stress, and that can give you the confidence that soil moisture data are the true value.

Photo 1. Actively growing shoot tips and tendrils indicate no water stress.

## 4. Manage Disease, Pest, and Weeds Proactively

Abundant soil moisture is certainly encouraging and fruitful for SJV growers after successive drought years. However, the big concern from a wet winter might be the favorable conditions for pests and disease due to the larger vine canopy and higher weed pressure promoted by excessive soil moisture. Rapid shoot growth after budbreak will likely create dense canopies and well-shaded cluster-zone which favor fungal pathogens, such as powdery mildew and botrytis. This is not only because of increasing the relative humidity under the canopy, but also by decreasing cluster-zone light exposure and fungicide spray coverage. Growers can use the combination of the UC IPM powdery mildew risk assessment index (https://ipm.ucanr.edu/weather/grape-powdery-mildew-risk-assessment-index) and field scouting to schedule the spray interval. Canopy size can also be managed through irrigation management.

Additional information on powdery mildew and botrytis fungicide efficacy and timing studied by Dr. Akif Eskalen can be found here: https://ucanr.edu/sites/eskalenlab/Fruit_Crop_Fungicide_Trials/

Another big concern after a wet winter is grapevine trunk disease which are fungal pathogens, such as Botryosphaeria and Eutypa. These pathogens enter the grapevine through pruning wounds under the condition of free water such as rain and dense fog. Although rain events were cheerful, they can significantly increase the risk of spreading grapevine trunk disease. To lower the risk of spreading trunk disease it is recommended to either practice delay pruning or double pruning (Photo 2), or to use fungicide spray right after pruning (Photo 3). Delay pruning and double pruning aim to expose the final pruning wounds to the warmer weather of February, rather than the cooler weather of December. This allows the pruning wounds to heal faster and avoid the pathogens' invasion. Fungicides can serve as a barrier on pruning wounds to protect vines from pathogens' attack. A study done by Dr. Akif Eskalen on fungicide efficacy and timing on grapevine trunk disease can be found here: https://ucanr.edu/sites/eskalenlab/Fruit_Crop_Fungicide_Trials/. However, right now it might be too late for some growers to implement either technique. It is still worth watching the vines, particularly in June or July when the temperature rises dramatically. Grapevine trunk disease typically shows the peak of the symptoms in the early or middle of the summer when the vine water demand is the greatest.

Photo 2. Mechanical pre-pruned vines followed by final hand pruning.

Typical grapevine trunk disease symptoms are: 1. Dead arm or cordon; 2. Canker on the cordon/trunk; 3. Stunted shoot; 4. Leaf discoloration (Photo 4).

Photo 3. Fungicide spray right after pruning.

Vine mealybugs have been the number one concern for many SJV growers in the past several years. This is not only because of the direct feeding damage on clusters but also due to its role as a vector of leaf roll virus-3 which can contribute to the sudden vine collapse. It is still unclear if the vine vigor might influence the vine mealybug population in the season. But it has been studied that high vine vigor increases the vineyard leafhoppers population (Daane and Costello 1998). Given that both leafhopper and vine mealybug feed on the grapevine to reproduce, it might be reasonable to assume that high vine vigor promoted by abundant soil moisture, like this past winter, also increases the vine mealybug population. Mating disruption combined with pesticide use can offer good protection from vine mealybug. Management strategies for sudden vine collapse include flagging, testing, removing, and

Photo 4. Left: dead cordon/arm. Middle: canker on the trunk. Right: leaf discoloration caused by Esca

replanting. Label the disease symptom vines, test positive in the lab, remove the virus-positive vines, and replant with less susceptible rootstock. Research is still ongoing at UC Davis to study the susceptibility of various rootstocks to sudden vine collapse, and currently, we know the rootstock Freedom is highly susceptible to sudden vine collapse. Following those steps can minimize the spread of the virus as well as sudden vine collapse.

Cited literatures:

Daane, K. and Costello, M. 1998. Can cover crops reduce leafhopper abundance in vineyards? California Agriculture. 52(5):27-33. https://doi.org/10.3733/ca.v052n05p27

**Passive Measures to Reduce Impacts of Late Spring Frosts**

**Dr. Justin Tanner, UCCE Viticulture Farm Advisor**
**Dr. Horst Caspari, Colorado State University Professor and State Viticulturist**

**Grape Cold Hardiness and Freezing Injury**

Cold tolerance in grapevine is a dynamic process that changes over the course of the season in response to preceding weather exposure. In the fall, as nighttime temperatures gradually decrease, the vines acclimate and become more resistant to cold temperatures. Late ripening varieties generally acclimate slower in the fall and may be more susceptible to cold damage when unseasonably warm and wet conditions precede the first freezing event in the fall. By midwinter, the vines have attained their maximum cold tolerance and are able to withstand very cold weather. Some varieties can withstand temperatures below -7$^{o}$F without injury. In the spring, however, as temperatures warm, growth resumes in buds.

In California's wine-growing regions, the most common cold weather threat we experience is late spring frost. Developing buds swell and begin losing cold tolerance making them vulnerable to frost. After bud break, actively growing shoots can be damaged by brief exposure to air temperatures a couple of degrees below freezing (<30$^{o}$F). Cultivars that deacclimate earlier in the spring are the first to go through budbreak, putting them at risk of frost damage earlier in the spring. Each cultivar will vary in the start of acclimation/cold hardiness in the fall, degree of freeze resistance in midwinter, as well as the timing of deacclimation and resumption of growth in the spring.

**Types of Freezes**

The type of cold weather event will affect the effectiveness of frost protection efforts so it's helpful to identify what type of event we are dealing with. Frost events are either radiative or advective (Figure 1).

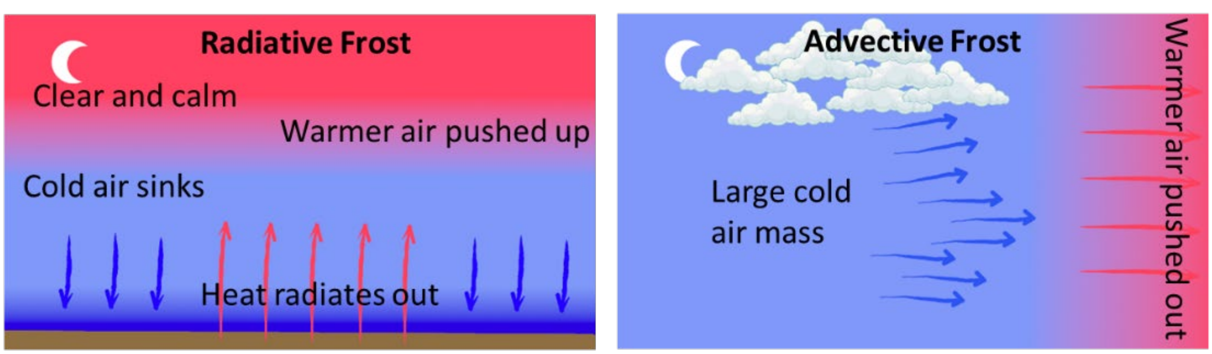


Figure 1. Frost events can be classified as either radiative or advective.

Radiative events occur on calm clear nights when more heat is lost than is absorbed by the ground resulting in a cooling effect. During a radiative frost, the coldest temperatures occur on the vineyard floor. In calm conditions, cold air which is heavier than warmer air slowly flows and accumulates in low spots. As a cold air layer builds, it displaces warmer air that is forced skyward. The development of a colder air layer below a layer of warmer is called a temperature inversion and is typical of radiative frost events. Inversion strength depends on the difference in temperature between the upper and lower layers. If the sky is cloudy during the formation of an inversion the strength is likely to be weaker because water vapor in clouds will trap heat radiating from the ground in the air. Conversely, when the night sky is clear, radiation that accumulates in the soil from the sun during the day will radiate out of the area into space creating the potential for a strong inversion having much cooler temperatures closer to the ground. Radiative frost events are short events usually only lasting a few hours and reach their coldest point just before sunrise.

In contrast to radiative freeze events which are fairly common in California's viticultural areas, advective freeze events are thankfully much rarer. Advective freezes occur when a large mass of very cold air moves into an area forcing warmer air out of the region. Advective events are accompanied by wind and lack a distinct temperature inversion. They can occur during the day or night and may last for several days giving them the potential to be much more damaging than radiative frosts.

There are many passive practices that can help to minimize the potential impact of radiative frost events such as site and cultivar selections, increasing cordon height, maximizing the drainage of cold air out of the vineyard, managing soil to increase heat exchange, and delaying pruning. These practices are classified as passive because they do not require active energy inputs during the event to mitigate frost. In areas such as the San Joaquin Valley where frost danger is low, active methods may not be economically viable. For this reason, we will focus on management strategies that aim to avoid frost through site selection, cultivar bud break date, pruning timing, trellis height, and maximizing the heat soil exchange capacity through vineyard floor management to reduce frost severity.

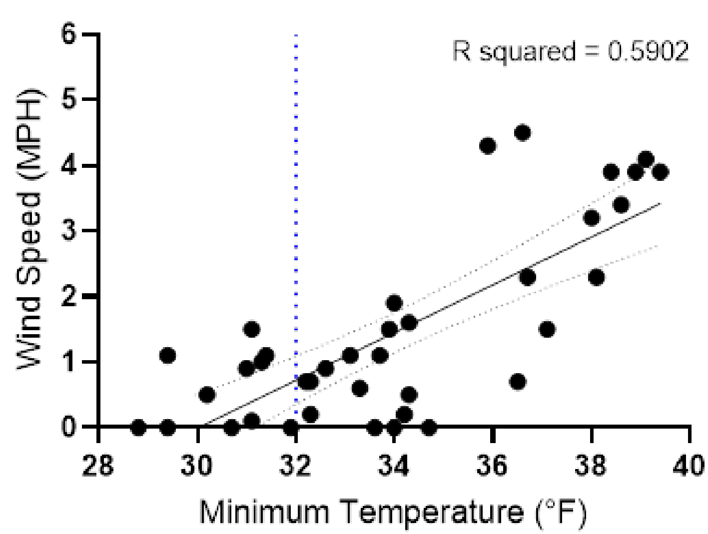


Figure 2. Relationship of air temperature and wind speed at 7am on April 12, 2022 from 38 weather stations located around Lodi, CA. Data provided by Lodi Winegrape Commission and Western Weather Group (https://lodi.westernweathergroup.com/)

**Spring Frost Event of 2022 in Northern San Joaquin Valley**

Last spring many vineyards around Lodi experienced frost damage during the early morning hours of April 12. According to weather data available on California Irrigation Management Information System (CIMIS) stations located in San Joaquin County, air temperatures at two of five weather stations briefly dipped below freezing. Linden weather station (CIMIS #262) recorded a low temperature of 28.3$^{o}$F while the Staten Island station (CIMIS #242) reported a low of 30.8$^{o}$F. CIMIS station air temperature sensors are located about 4'11" (1.5m) above the ground. Freeze injury from this event was unevenly distributed with low-lying and wind-sheltered areas receiving the most damage while many vineyards escaped damage completely.

The Lodi Winegrape Commission provides weather data from the Western Weather Group for numerous locations around Lodi and highlights the diversity of conditions resulting from individual site microclimates within the Northern San Joaquin Valley region. Looking into data from 38 individual weather stations for the April 12 frost event shows that at locations where wind speeds were lower temperatures were generally colder (Figure 2). This relationship between wind speed and air temperature is typical for a radiant frost event. Wind allows for the mixing of cold and warmer air reducing differences in temperature between measurements close to the ground and higher up. In an example of a similar frost event in Western Colorado, differences in temperature at 6” and 64” are larger when wind speed is low and shrinks when the wind increases (Figure 3).

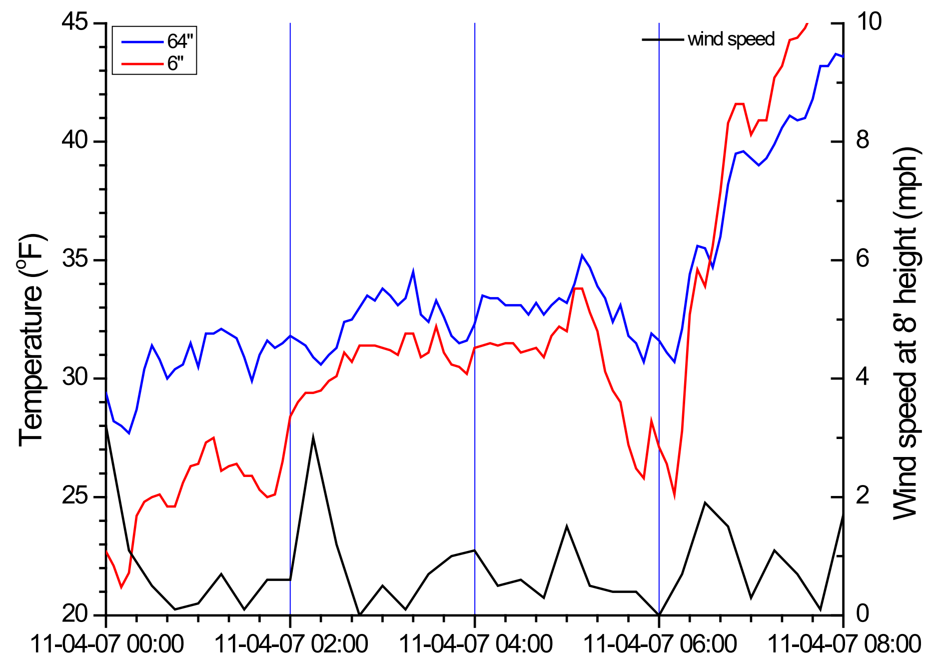


Figure 3. Example of vertical temperature differences within a vineyard during a typical inversion night in April 2007 recorded in Western Colorado.

**Site Considerations**

Each vineyard will have its own unique features that will influence frost potential. It is helpful to identify cold spots that are more likely to freeze. As cold air is heavier than warmer air, it will sink and accumulate at the lowest point in the vineyard during a radiative event. In established vineyards, areas of concern may be identified by prior frost damage seen in previous years. Low areas will also accumulate water after heavy rains and highlight areas where cold air can collect.

When establishing a new vineyard, careful grading will reduce the development of cold air pockets. Cultivars that break bud later in the spring can be planted in the coldest spots in the vineyard to reduce frost risk. Slope direction can also influence temperature at a site. South-facing slopes will promote budbreak earlier than north-facing slopes. In a vineyard that contains various topographical features such as slopes, valleys, and hills, management zones can be established to simplify vineyard operations

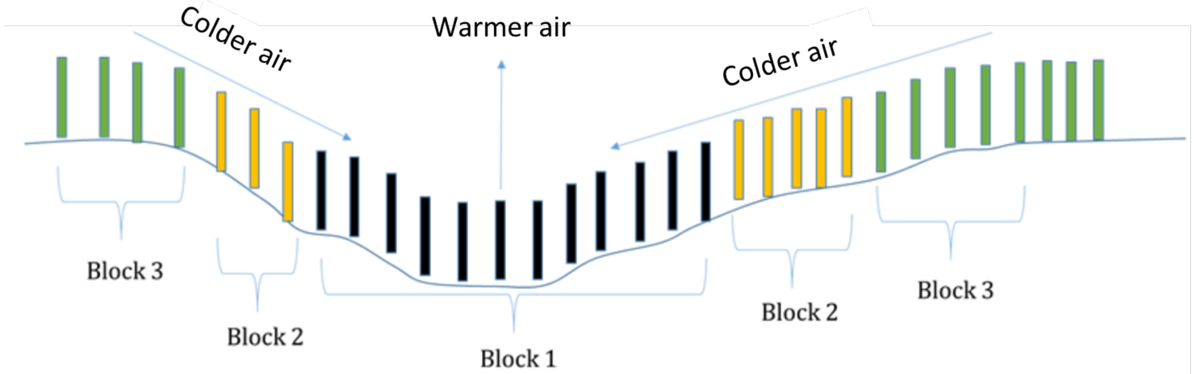


Figure 4. Zoning of vineyard blocks management based on frost potential can be useful in simplifying operations to reduce risk. In this example a low-lying portion of the vineyard is identified as having the greatest potential for the accumulation of cold air and frost damage and designated as management Block 1.

(Figure 4). As the coldest temperatures during spring frosts are at ground level, increasing cordon height will increase the temperature around sensitive young shoots and clusters. Low cordons located closer to the ground will be more likely to experience colder more challenging temperatures.

**Minimizing Cold Air Accumulation**

It is important to not block cold air from moving out of the vineyard. Inspect the perimeter of the site for physical barriers to cold air movement. Trees, tall vegetation, fences, and buildings can block the movement of cold air. On sloped sites, removing obstructions on the low side of a vineyard can reduce frost potential. Tall ground cover can also trap cold air and lower the area of the coldest temperature from the ground up closer to the height of the cordon. Upslope of the vineyards, well-placed obstructions such as hedges or fences can be useful to reduce cold air flow entering the site.

**Maximizing Heat Capture by the Soil**

During the day, sunlight falling on the vineyard floor will warm the ground, which will release that heat during the night. Any practices that increase the exchange capacity of this solar radiation can help to reduce frost severity. Bare soil will collect and store heat from the sun more efficiently than soil with vegetative cover. Cover crops insulate the soil like a blanket, reducing the amount of heat entering during the day and leaving at night. Where cover crops are used, mowing a few days before a frost event will allow the soil to store and release more heat than unmowed cover crops. Soil moisture also plays a beneficial role in improving heat storage, with moist soil holding more heat when compared to dry soil. Recently tilled soils are light and fluffy having more air pockets that will reduce heat storage capacity in comparison to firmer, settled soil. Recently tilled soil should be flattened and packed to reduce this insulation effect well in advance of an expected frost event.

**Delaying Budbreak**

Delaying winter pruning can have a beneficial effect on delaying budbreak and extending cold hardiness. Late pruning can delay budbreak by as much as 15 to 20 days and increase the chance that sensitive tissues will avoid cold exposure by developing after the risk of frost has passed (Poni et al. 2022).

Figure 5. Prepruning of dormant vines in Fresno County. Photo by George Zhuang

Mechanical prepruning to seven or eight nodes can be accomplished at any time during the dormant season, followed by final pruning closer to budbreak (Figure 5). This practice is helpful in reducing labor requirements and is especially useful for managing large vineyards in a timely manner. Final pruning can be delayed up to the unfolding of the second or third leaf on apical shoot positions with little impact to yield. If pruning occurs after this stage however, it can result in reduced yield, delayed harvest date, and additional strain on the vine's stored carbohydrates reserves which may affect its ability to respond to stress in the future. Despite the challenge of accomplishing the final pruning in a timely manner, delayed pruning carries the additional benefit of reducing the chances of infection by trunk diseases which will enter through pruning wounds. These wounds heal slower in cool conditions which allows them to be susceptible to infection for a longer period. In large vineyard operations where labor constraints may affect the ability to prune the entire vineyard on time, pruning can begin with the least at-risk areas reserving low-lying and wind-sheltered locations for pruning last. In flat terrain, consider pruning earlier bud-breaking cultivars after cultivars that break bud later.

**Assessing Damage After Spring Frosts**

After a spring frost event, the damage will not be immediately noticeable. Once temperatures return to seasonal norms, the injury will usually take two to three days to fully express itself (Figure 6). Freeze damage on green tissues such as shoots, leaves, and clusters occurs due to ice formation in cells damaging cell walls. This allows phenolic compounds to leak out of cells and oxidize resulting in brownish discoloration of affected tissues. Once evident, damage can be assessed by counting the number of


Figure 6. The extent of frost damage is difficult to fully evaluate visually immediately after a late spring frost event. A) Wilted shoot tip after freezing and thawing is still green. B) A few days after a frost event damaged tissues show oxidative browning on leaves and clusters. Photos by George Zhuang

undamaged shoots of each cultivar in the vineyard. If damage is uneven across the vineyard, assessment based on zones grouped by damage level can give a more accurate account of potential losses. When frost injury occurs on shoots shorter than five inches, clusters are more likely to be damaged, reducing yield potential. Longer shoots, if not completely damaged, can still produce a crop if the bottom four to six nodes are unharmed. Death of the shoot tip however can initiate the growth of lateral buds that may crowd the fruiting zone posing additional complications.

**Summary**

Spring frost damage occurring after budbreak is the most common cold weather hazard faced in California's wine-growing regions.

Damage to young shoots can occur at temperatures just below freezing.

While each site is different, understanding the unique features of your vineyard can inform management.

Promoting cold air drainage and increasing soil heat exchange capacity will reduce frost severity.

Delaying final pruning can reduce frost risk by delaying budbreak and extending cold hardiness a few days longer.

**Additional Frost Resources Online**

Department of Land, Air and Water Resources, UC Davis *Frost Protection* Video
https://lawr.ucdavis.edu/cooperative-extension/frost-protection

CalAgroClimate http://agroclimate.org/

California Irrigation Management Information System https://cimis.water.ca.gov/

Lodi Winegrape Commission and Western Weather Group https://lodi.westernweathergroup.com/

**Further Reading**

Moyer, Michelle, et al. "Assessing and managing cold damage in Washington vineyards." Washington State University Extension EM042E (2019). http://pubs.cahnrs.wsu.edu/publications/wp-content/uploads/sites/2/publications/em042e.pdf

Poni, Stefano, et al. "Facing spring frost damage in grapevine: recent developments and the role of delayed winter pruning–a review." *American Journal of Enology and Viticulture* 73.4 (2022): 211-226.

Snyder, Richard L., and JP de Melo-Abreu. "Frost protection: fundamentals, practice and economics. Volume 1." *Frost protection: fundamentals, practice and economics* 1 (2005): 1-240.

**Biostimulants in Raisin Grapes**

**Joy Hollingsworth, UCCE Table Grape Advisor, Tulare, and Kings Counties**

Biostimulants are a broad category of products that use naturally occurring ingredients intended to stimulate plants into better performance. Officially recognized in the 2018 Farm Bill, they were defined as "a substance or micro-organism that, when applied to seeds, plants, or the rhizosphere, stimulates natural processes to enhance or benefit nutrient uptake, nutrient efficiency, tolerance to abiotic stress, or crop quality and yield." Biostimulant products all have unique components and modes of action which might not be clearly identified. Product categories include but are not limited to: humic, fulvic, amino, and organic acids, beneficial microbes, extracts, biopolymers, and inorganic compounds. Private research conducted in the San Joaquin Valley suggested that some biostimulant products enhanced the quality of table grapes, improving the uniformity of berry size and color (Vasquez, personal communication). With the success of biostimulant applications experienced in table grapes, a similar trial was organized in an underperforming raisin grape vineyard to see if yield or quality could be improved.

In the spring of 2021, a trial was established in a six-year-old raisin vineyard (Vineyard A) in Fresno County with a history of inadequate yield and quality. Several years of poor winter precipitation, record-breaking heatwaves, and irrigation pump failures made it challenging to sufficiently water the vines, which had poor growth and low capacity, with yields of less than one ton of raisins per acre. The industry average for a mature overhead raisin vineyard is four to five tons per acre. The vineyard is on Tujunga sandy soil (Table 1) and was planted with Selma Pete on Freedom rootstock. The vines were head-trained and cane-pruned on an overhead trellis. Treatments included three different commercial biostimulant products (microbial, carbon-based, and seaweed-based) in addition to the grower's standard fertilizer program representing the control. All three products were injected through the vineyard's drip irrigation system (Image 1) similar to the grower's fertilizer. The products were applied three to four times per year, depending on the companies' standard protocols, while the control was applied at the grower's discretion.

Table 1. Trial Design

| Year | Location | Variety | Soil Type | Vineyard spacing | Row Length | Reps | Treatments |
|---|---|---|---|---|---|---|---|
| 2021 | A | Selma Pete on Freedom | Tujunga Sand | 5' x 11' | 125 vines | 4 | 4 |
| 2022 | A | Selma Pete on Freedom | Tujunga Sand | 5' x 11' | 125 vines | 4 | 4 |
| 2022 | B | Selma Pete on Freedom | Hanford fine sandy loam | 5' x 11' | 41 vines | 4 | 4 |

Treated vines were monitored throughout the season. Leaves and petioles were sampled at bloom, veraison, and pre-harvest and sent to a commercial lab for nutrient analysis. Prior to cutting the canes in mid-August, 30 berries per vine were collected from each treatment replicate. Average berry length, width, and weight were determined, and then the berries were crushed and total soluble solids (TSS) were measured from the juice. After the canes were cut and the grape clusters sufficiently dried into raisins, each replicate was hand harvested, and yield, moisture, and quality were determined.

Image 1. Biostimulant product being injected through the drip system

The experiment was repeated in 2022 after improvements were made by the addition of compost and more organic amendments applied through the drip system by the grower. Additional water was also applied to the trial site by the grower throughout the season, which improved canopy growth.

A second vineyard site (Vineyard B) was added to the trial in 2022. The second vineyard was in close proximity to the first but planted on a Hanford fine sandy loam. Vineyard B mirrored the first vineyard, having the same variety, trellis, and was approximately the same age. However, it was better performing with yields matching the industry average of 4 tons per acre. The addition of the second vineyard was to determine if biostimulant effectiveness was consistent when tested in a vineyard with stronger vines and in which cultural practices may be somewhat different.

The same protocols were used in 2022 as in 2021, with the exception that one product had changed from four yearly applications to three.

Results and Conclusions

Statistical analyses indicated that neither year nor location interacted with the treatments to affect yield or quality, so data from both sites were combined. Combining the data from both sites increased the strength of the study but, even so, it was determined that none of the products significantly affected raisin yield or quality more than the grower control (Table 2). However, there were significant effects of vineyard and season (Table 3). The grower from Vineyard A was able to dramatically increase his yields and quality in the second year, but improvements were not the result of the biostimulant treatments. However, the yield increase did not meet the industry average for Selma Pete grown on an overhead system. In contrast, Vineyard B was able to produce three more tons than the industry average in 2022 in this trial.

Table 2. Treatment effect on yield and quality

| Treatment | Adjusted Yield Ton/Acre at 14% moisture | Moisture (%) | Substandard (%) | B or Better (%) |
|---|---|---|---|---|
| Microbial | 3.7a | 11.3a | 1.3b | 82.0a |
| Carbon | 3.7a | 11.1a | 2.9a | 74.2a |
| Seaweed | 3.5a | 10.9a | 1.5ab | 80.9a |
| Grower standard | 3.9a | 11.1a | 2.3ab | 79.6a |

*Values are means of all three trials. Means followed by a different lowercase letter within a column indicate a significant difference at $p<0.05$

This trial did not find any significant benefits to any of the three products that were tested. However, it should be acknowledged that this was a relatively small trial, that was only conducted over two years in two locations. It should be considered preliminary, and more, larger studies may be needed to come to a robust conclusion.

Table 3. Year and location effect on yield and quality

| Year | Location | Adjusted Yield Ton/Acre at 14% moisture | Moisture (%) | Substandard (%) | B or Better (%) |
|---|---|---|---|---|---|
| 2021 | A | 0.7c | 11.4a | 2.7a | 68.3c |
| 2022 | A | 2.7b | 11.0a | 0.4b | 90.0a |
| 2022 | B | 7.7a | 10.8a | 2.9a | 79.2b |

*Values are treatment means. Means followed by a different lowercase letter within a column indicate a significant difference at $p<0.005$

If a biostimulant product interests you, and you want to see if it can help you solve a problem in your vineyard, it is advisable to do an on-farm trial, possibly in partnership with the manufacturer, a Certified Crop Advisor, or a UC farm advisor. They can help you design a trial that can be easily managed, determine what kind of data should be collected, and show you how to keep good records and analyze the results.

**Erratic Bud Break and Irregular Shoot Growth in Spring: Potential Causes and What Can Be Done to Fix Them.**

**Tian Tian, Viticulture Farm Advisor Kern County**

Budbreak is the first observable phenological stage at the start of the new growing season. Variability in budbreak can be caused by a variety of factors including adverse weather conditions, disease problems, and pest issues, and can even be a characteristic of certain varieties. Uneven budbreak has a domino effect across the growing season by increasing variability during bloom, which will also increase the number of harvest passes for a vineyard. This unevenness will complicate the timing of bloom sprays and make harvest events impossible to set up evenly across a vineyard. This variability is not always noticeable directly after budbreak but will become more evident once shoots are around one-foot tall. This article will provide the main causes and mitigation solutions for erratic bud break and uneven shoot growth, as well as insights on monitoring for problems.

***Winter weather.***

The uniformity of bud break can be affected by winter weather, even though vines are dormant at that time. Buds need exposure to low temperatures (32 to 45 °F) for a period of time in the winter to break dormancy. Despite debates over the number of chilling hours required for optimal bud break, it is clear that insufficient chilling contributes to variable shoot growth in the spring. To overcome the issue involving a lack of chilling, Dormex ($H_2CN_2$) is an effective product used to increase the uniformity of bud break and possibly advance its occurrence. The use of Dormex is popular in table grape vineyards. However, it is worthwhile noting that some growers observed a decrease in vine longevity upon regular Dormex use. However, this effect has not been described in the literature. Dormex is highly toxic, so caution should be used when applying this product. We are currently conducting bud stimulant trials in 2022 and 2023 to evaluate newer products that may serve as alternatives to Dormex. Check back in with future editions of VitTips for the results of those trials.

Low precipitation in the winter is another factor contributing to variable bud break and delayed shoot growth in the spring. Under normal moist soil conditions, roots supply water through xylem tissue for the swelling bud. However, when the soil is too dry, the roots are unable to supply enough water. This leads to the formation of air bubbles, known as embolisms, in the xylem vessels. In severe cases, buds are not able to rehydrate properly. This can lead to a disconnection between the bud and the rest of the vine's vascular system, leading to issues with the transportation of nutrients and water to the young shoots in spring. As a result, shoot growth is stunted and cluster development can suffer from poor canopy development. We encountered the issue of delayed spring growth in 2021. If these conditions return in a future year, irrigation prior to budbreak to refill the soil moisture profile will help prevent the poor canopy development seen in the spring of 2021. Luckily, the cold rainy weather we had this winter would protect us from a such problem in 2023.

***Variety characteristics*.**

Some grape varieties have strong apical dominance. This leads to buds on the distal end of the cordon breaking bud first and slowing down budbreak on the rest of the cordon. In old days, growers would assign crews to remove the distal young shoots manually during bud break, to improve bud uniformity. However, this practice has become cost inhibitive with current labor rates. Bud stimulants, such as

Dormex, are applied to mitigate the variability in bud break in those varieties. Moreover, varieties that lag on dormancy appear to have more issues in variable bud break. Delaying pruning may help with such situations.

***Vine diseases***.

Erratic bud break can be an indicator of vine decline due to disease issues, such as trunk disease and crown gall. Trunk disease is a chronic disease caused by fungal pathogens colonized in arms, cordons, and trunks. The pathogens that cause trunk disease enter the vine through wounds, they can cause necrosis of the perennial wood structures (arms, cordons, and trunks). As the fungi slowly spread in the permanent wood structures, they reduce the vine's ability to supply water to portions of the vine past the infection. As the fungal pathogens move relatively slowly, you will find tiny shoots adjacent to normal young shoots in one vine, during the early to mid-stage of infection. Usually, trunk disease is found in older vineyards (> 10 years old) than in young vineyards.

Some trunk disease pathogens are more aggressive than others, but prevention is a powerful tool, nevertheless. Spores of trunk disease pathogens release under cold and wet conditions. Delaying pruning and avoiding pruning right before rain reduces wounds presenting at the time when spores prevail. Applying wound protectants is also effective to protect vines. For product selection, please see the reports on pruning wound protection trials from Dr. Akif Eskalen's lab at UC Davis (https://ucanr.edu/sites/eskalenlab/Fruit_Crop_Fungicide_Trials/).

In addition, crown gall is a disease caused by a bacteria called *Agrobacterium vitis*. Galls can be found in cordons, trunks, and roots. This disease occurs more often in cool production regions where cold injury presents.

***Pest issues.***

Pests like cutworm feed on buds and young shoots. If you suspect that uneven bud break may result from pest issues, please use the checklist developed by UC IPM for table grape (https://ipm.ucanr.edu/agriculture/grape/table-grapes-delayed-dormancy/) and raisin/wine grapes (https://ipm.ucanr.edu/agriculture/grape/wine-and-raisin-grapes-delayed-dormancy/) for monitoring guide.

Figure 1. Photo of bud break status at the end of March in a table grape vineyard

Also, in own-rooted vineyards, parasitic nematodes, and phylloxera can lead to the gradual decline of vines. The slow shoot growth in the spring can be related to the loss of root mass due to their activities.

**Monitoring bud break and early shoot growth**

I found keeping records using pictures is a quick and easy way to monitor bud break and shoot growth in the spring. To do so, I start with labeling a few vines in one vineyard block with color flagging wrapped around the trunk and writing the block number and row number on the flagging. Then take pictures of flagged trunks and canopy periodically. The pictures need to be clear enough to see the young shoots without inferences of other vines in the background (example as shown in Figure 1). Saving pictures in designated albums is recommended. As most phones would record the time and GPS location of pictures, one could sort photos by location or by date for future reference. Please note that the GPS of pictures may not be accurate enough to separate vineyard blocks in areas with poor phone service. Satellite images can also be helpful to compare vine growth between years at a similar time. Please see the article written by Mark Battany on using satellite NDVI for vineyard diagnostics (https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=46551).

**Vineyard Weed Control After a Wet Winter**

**Karl Lund Viticulture Advisor Madera, Merced, and Mariposa Counties**

The California Department of Water Resources maintains 5 precipitation monitors in the Sierra Mountain foothills within the headwaters of the San Joaquin River. These monitors are used to track the amount of rainfall in the region that supplies the San Joaquin Valley with the bulk of its water supply. These monitors can also be used to compare current trends in rainfall with historic high and low rainfall events. The average rainfall is 39.9 inches per rainfall year. The two driest rainfall years on record are 1923-1924 (14.6 inches), and 1976-1977 (15.4 inches). While the two driest years occurred some time ago, the next three driest years on record were much more recent. The 3rd driest is 2020-2021 (18.8 inches), the 4th driest is 2014-2015 (19.0 inches), and the 5th driest is 2013-2014 (20.4 inches). On the other extreme, the wettest two rainfall years on record were 1982-1983 (77.4 inches) and 2016-2017 (72.7 inches). 2018-2019 (50.0 inches) was also on the wetter side, being the 21st wettest rainfall year on record. The 2022-2023 rainfall year is now on track to be one of the wettest with over 58 inches of rain. With more rain in the forecast before the end of March, and all of April left to accumulate more rain. This already large total amount of precipitation will affect how the 2023 growing season in several different ways.

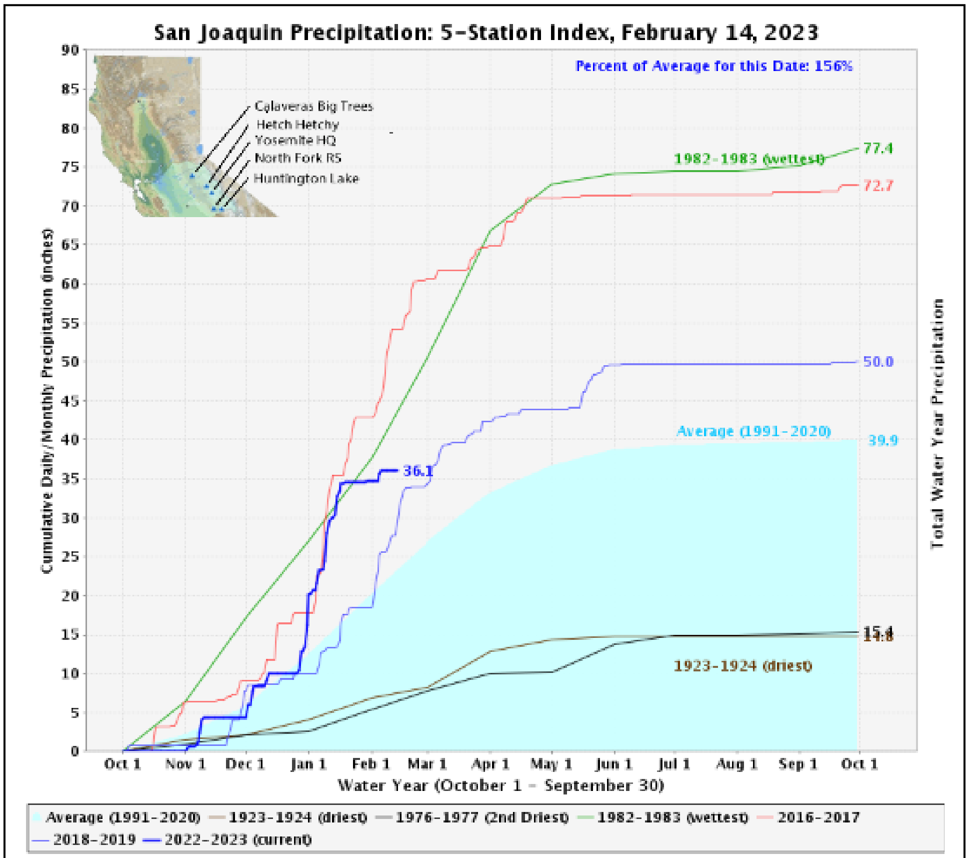


Image 1 Rainfall totals in the portion of Sierra Nevada Mountain foothills that are the headwaters of the San Joaquin River. Current rainfall through February 14, 2023 (dark blue) is compared to 1982-1983 (green), 2016-2017 (light brown), 2018-2019 (blue), average rainfall across 1991-2020 (light blue), 1976-1977 (black), and 1923-1924 (dark brown). Image downloaded from: https://cdec.water.ca.gov/precipapp/get5SIPrecipIndex.action on February 14, 2023

One of those effects, and the focus of this article, will be on weed management. The emergence of weeds is closely related to several factors including precipitation, land disturbance (tillage), and temperature (Roberts and Potter 1980, Roberts 1984, Werth et al. 2017). Specifically, it was found that rainfall totals above 10mm of precipitation would initiate weed emergence (Werth et al. 2017). Thus far this rainfall year we have had several events that would trigger weed emergence. November 7th and 8th combined crossed the 10 mm threshold, and December 1st, 3rd, 10th, 27th, and 31st each individually crossed the 10mm threshold, as did January 5th, 9th, 14th, and February 5th (table 1). Not only is this a large number of events, but they are also well spread out to trigger several separate weed emergence events. In addition, as there have been so many events, the soil has remained saturated for much of the winter allowing weeds to continuously germinate. This will make the weed pressure high in your vineyard to start the season. And if the rainfall continues, we could see even more weed pressure going forward. This will make weed management an important item to plan and get started.

Table 1. Rainfall totals near 10mm (0.4 inches) for CIMIS station 80 on the Campus of Fresno State for October 1, 2022, through February 14, 2023.

| Date | Rain (inches) | Rain (mm) |
|---|---|---|
| 11/7/2022 | 0.3 | 7.4 |
| 11/8/2022 | 0.3 | 6.6 |
| 12/1/2022 | 0.7 | 18.0 |
| 12/3/2022 | 0.9 | 23.4 |
| 12/10/2022 | 0.9 | 23.9 |
| 12/27/2022 | 1.4 | 35.6 |
| 12/31/2022 | 0.6 | 14.2 |
| 1/5/2023 | 0.5 | 13.2 |
| 1/9/2023 | 2.0 | 51.1 |
| 1/14/2023 | 0.8 | 19.8 |
| 2/5/2023 | 0.6 | 14.2 |

The first question to ask is when to start trying to control the weeds. While cover crops are often something that is planted, they can just as easily be the plants that emerged naturally. So, you can think of the plants (weeds) currently growing in your vineyard as a native cover crop. Cover crops can help prevent soil erosion and water runoff while increasing water infiltration and soil organic matter (Novara et al. 2021). These are all positive benefits to help prevent issues from heavy rains while saving more water in your soil profile for the growing season. Cover crops can also increase the biodiversity of the soil microbiome (Novara et al. 2021), improving soil health. And lastly, cover crops can increase arthropod diversity (Geldenhuys et al. 2021) leading to the possibility of more natural predators in your vineyard.

These are just a few reasons to consider allowing winter weeds to continue growing as long as the rains continue. However, weeds can lead to an increased risk of spring frost damage. By shading the soil surface weeds will reduce solar heating of the vineyard soil during the day. The soil releases this heat into the vineyard overnight. Thus, by shading the soil, weeds can lower the effectiveness of the soil to warm your vineyard and lead to a higher chance of frost damage. In addition, once the rains end the weeds will continue to use water and start to affect the grapevines in your vineyard. If water becomes limited in your vineyard's soil profile the weeds can devigorate the grapevines (Monteiro and Lopes 2007, Novara et al. 2021). Whether you are worried about water use, or frost damage, once the growing season starts the extra weed growth a wet winter has brought us should be dealt with.

To begin controlling the weeds in the vineyard means putting equipment into the field. However, putting heavy equipment into the field while the soil remains saturated can cause soil compaction. As your equipment passes over saturated soils it creates compacted soil layers leading to hardpans within the soil profile. These compacted soils and hardpans make it harder for the vine's roots to easily spread throughout the soil profile, limiting the growth of your vine's roots. Compacted soils and hardpans also make it hard for water to penetrate deep into the soil profile. This can make your irrigation less effective at wetting deep soil layers, and leave your vineyard open to worse runoff and erosion when the next heavy rainfall year happens. Overall, it may be best to wait until after the soil profile begins to dry before putting heavy equipment into the vineyard.

Tillage of the soil adds another soil layer to the compaction discussion. As we just discussed bringing tillage equipment into the vineyard while the soil is still saturated runs the risk of creating deep compaction layers in the soil. But tillage before a rain event can also lead to surface layer crusting of the soil. When rains interact with the unprotected soil surface, it can form a crust on top of the soil. This crust prevents water penetration leading to more issues with runoff in your vineyard. Preventing surface soil crusting can be done with cover crops (another advantage of holding off on removing weeds) or other residual plant material left on top of the soil surface. Soil surface crusting can be broken up afterward with a ring roller. However, this is another activity that you will need to work into an already busy spring growing season.

Table 2. Water Solubility and Soil Adsorption of preemergent herbicides registered for use in California vineyards.

| Preemergent Herbicide | Water Solubility (mg/Liter) | Soil Adsorption ($K_{oc}$) |
|---|---|---|
| Dichlobenil | 21.2 | 257 |
| Diuron | 35.6 | 680 |
| Flazasulfuron | 2100 | 46.2 |
| Flumioxazin | 0.786 | 889 |
| Indaziflam | 2.8 | 1000 |
| Isoxaben | 0.93 | 909 |
| Napropamide | 74.0 | 839 |
| Norflurazon | 34 | 700 |
| Oryzalin | 1.13 | 949 |
| Oxyfluorfen | 0.116 | - |
| Pendimethalin | 0.33 | 17491 |
| Pronamide | 9.0 | 840 |
| Rimsulfuron | 7300 | 50.3 |
| Sulfentrazone | 780 | 43 |
| Simazine | 5 | 130 |
| Trifluralin | 0.221 | 15800 |

Data from Pesticide Properties DataBase, University of Hertfordshire. https://sitem.herts.ac.uk/aeru/ppdb/en/index.htm

The use of preemergence herbicide is another control method that may not work as well as during a wet year. Again, applying preemergent herbicide to your vineyard does carry a risk of soil compaction. However, if your vineyard soil dries out quickly you may be able to get in an application between rain events. Preemergent herbicides require some rain or irrigation to properly incorporate into the soil profile, but too much rain or irrigation can dilute preemergent herbicides making them less effective. The likelihood of a preemergent herbicide being diluted by rain event depends on solubility in water and soil adsorption. Herbicides with greater solubility in water are more easily washed away. And the lower soil adsorption a preemergent herbicide has the easier it will be to wash away. Table 2 shows a list of water solubility and soil adsorption for preemergent herbicides labeled for vineyard use. If you use a preemergent herbicide with high water solubility and/or low soil adsorption prior to a major rain event there is a possibility that its efficacy will be lowered.

Wet winters also make it difficult to make effective use of postemergence herbicides. Considering that the first rain event that could have triggered weed growth was back in early November, the weeds growing in San Joaquin Valley vineyards are going to be fairly large by now. For postemergence herbicides the larger the weed the lower the efficacy the herbicide will have. Work done on Hairy Fleabane found that glyphosate, glufosinate, paraquat, and saflufenacil could all achieve 100% weed control when sprayed at the 4-5 leaf stage. However, when sprayed on larger bolting plants glyphosate still managed 93% weed control, while glufosinate and paraquat fell to 64% and 60% weed control respectively, and Saflufenacil only managed 37% weed control (Sosnoskie 2017). While hairy fleabane is a summer weed, the same holds true for winter weeds. Meaning that the larger weeds will need either a second pass or additional methods to get them under control. In addition, larger winter weeds can also physically block efficient herbicide application on young (small) summer weeds. Giving the summer weeds a chance to outgrow easy control and giving you a second reason to get your weeds under control as soon as the soil allows you into the vineyard.

Mechanical control methods can complement postemergence herbicides. Once the soil has dried down and the rains have slowed tillage will again be a viable option to downsize the weeds growing in your vineyard. This would allow postemergence herbicides to again be efficient in controlling weed growth and regrowth. However, tillage does have negative effects even once the risk of soil compaction has passed. Tillage lowers soil health (Lazcano et al. 2020) and has higher levels of greenhouse gas emissions (Zumkeller et al. 2022). Mowing is another option for reducing weed pressure and potentially improving postemergence herbicide performance. Mowing will also leave residual plant material on the soil surface to help prevent soil crusting if rains continue into the growing season. Cover crops terminated by mowing also saw a 45% higher water infiltration when compared to tillage termination (Zumkeller et al. 2022). This would indicate that mowing instead of tillage would help to allow spring rains to better infiltrate into your vineyard soil which would be beneficial should any further rainfall occur as it would help save more water in the vineyard soil, thereby reducing irrigation demand in the first part of the growing season. Overall, this makes mowing weeds a better option for regaining control over weed growth in combination with herbicides.

Conclusion

The 2022-2023 rainfall year has already been especially wet with no end in sight. This extra precipitation will lead to an excess in weed growth to start off the 2023 growing season. Wet soils can also prevent timely access to the vineyard delaying the ability to start dealing with this elevated weed pressure. The excess precipitation and excessive weed growth can lower the efficiency of both pre and postemergence herbicides. Therefore, it is best to use mowing, mixed with some tillage after the threat of major rain has passed, to bring weed growth under control. Postemergence herbicide can then be used to maintain the level of control you need for your vineyard operations.

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**Upcoming Meeting**

**Crop Manage Workshop and In-field training:**
**Using a pressure chamber for irrigation scheduling in trees and vines**

**Date:** April 19th, 2023

8:00 AM- 12:30 PM: Crop Manage Workshop

12:30-1:15 pm Free Lunch

1:15 - 3:00 pm Hands-on pressure chamber training in trees and vines

**Location:** UC Kearney Agricultural Research and Extension Center

9240 South Riverbend Ave, Parlier, CA 93648

**Sponsors:** UC ANR and CDFA-FREP

**Meeting Agenda**

**Session I – Crop Manage Hands-on Workshop**

8:00 – 8:30 am: Registration and computer set-up**
8:30 – 9:00 am: Introductions
9:00 – 10:30 am: Getting started with CropManage.
10:30-10:45 am Break
10:45 – 11:30 am Using CropManage for decision support and record-keeping.
11:30 am – 12:15 pm Group exercise
12:15- 12:30 Questions & Answers
12:30- 1:15 pm - Lunch

**Who should attend:** Growers, farm managers, other farm staff, crop advisors, consultants, and technical service providers. The workshop is for new and existing CropManage users.

**What to bring:** This is a participatory workshop. Please arrive early and bring a tablet or laptop computer so that you can follow along and participate in the exercises. Each participant will need a user account for CropManage. Please set up a free user account at https://cropmanage.ucanr.edu/ before the workshop. Not familiar with CropManage? Learn more by visiting the CropManage help page or contact Mike Cahn at mdcahn@ucanr.edu

CropManage is a free online decision-support tool for water and nutrient management of vegetables, berry, agronomic, and tree crops. Based on in-depth research and field studies conducted by the University of California Cooperative Extension, CropManage provides real-time recommendations for efficient and timely irrigation and fertilization applications while maintaining or improving overall yield.

**Session II – In-field training with pressure chamber for irrigation scheduling**

1:15 – 1:30 pm Principles of using the pressure chamber to measure the plant water status.

1:30 - 3:00 pm UCCE Advisors provide in-field training on how to use a pressure chamber in almonds and vines. *Equipment will be provided for the training

**San Joaquin Valley Wine Growers Association**
**Grower Field Meeting: Vineyard Pest and Disease Management After a Wet Winter**

**Date**: April 12th, 2023

9:00 AM to 12:00 PM

**Location**: Biscay Family Vineyards, 6382 Golden State Blvd. Madera, CA 93637.

**Agenda**

How to Sample for Red Blotch & Leaf Roll Virus
Alan Wei, Agri-Analysis Lab

How to Manage Glassy Winged Sharpshooters, The Vector of Pierce's Disease
Rodrigo Krugner, US Department of Agriculture

Technical Overview: Xyl-Phi PD® for the Management of Pierce's Disease in Vineyards
Israel Luna, A&P Inphatec Field Tech Representative

Grapevine Mineral Nutrition
Matthew Fidelubus, UCCE Kearney Ag

Sprayer Calibration
Peter Ako Larbe, UCCE Kearney Ag

12:00 PM Lunch

**Registration**: SJVWA Spring Field Day Tickets, Wed, Apr 12, 2023, at 9:00 AM | Eventbrite