Welcome Back To Vit Tips

Karl Lund, UCCE Madera, Merced & Mariposa Counties
Gabriel Torres, UCCE Tulare & Kings Counties

After a short break the Vit Tips Newsletter is back with a new lineup. The only constant in life is change, and the makeup of your Viticulture Advisor personnel serving the San Joaquin Valley is no different. Over the past two years Dr. Allison Ferry-Abee, Dr. Ashraf El-Kereamy and Lindsay Jordan have moved on to new career opportunities outside of San Joaquin Valley viticulture. The recruitment process has begun to refill the Viticulture Advisor position in Kern county, and we will hopefully be able to introduce you to the new Kern County Viticulture Advisor in a future newsletter. At this point I would like to introduce the two new Viticulture Advisors who have been on the ground since early 2018. Dr. Karl Lund started in January of 2018 in the Viticulture Advisor position in Madera covering Madera, Merced and Mariposa counties. Dr. Gabriel Torres started in February 2018 in the Viticulture Advisor position in Tulare covering Tulare and Kings counties.

Dr. Karl Lund received his Ph.D. in genetics from UC Davis in 2014. His Ph.D. work was completed in the laboratory of Dr. Andy Walker researching phylloxera biodiversity and the understanding the resistance of rootstocks and grape species. Karl's work identified new feeding types of phylloxera, in addition to the previously identified Biotype A and Biotype B phylloxera. His work also investigated the genetic diversity of phylloxera within California and across their native habitat in the Eastern and Southwestern United States. In addition to his research Karl was the teaching assistant for multiple classes while at UC Davis including: viticultural practices, crop evolution, genetics, and molecular genetics laboratory. He finished his time at UC Davis with a short post doc looking into the genetics of root angle, a trait associated with drought avoidance in grapevines.

After his time at UC Davis, Karl spent the 2015-2016 academic year lecturing at Cal Poly San Luis Obispo. There he taught classes including: Introduction to viticulture, viticultural pest management, as well as global wine and viticulture. After this Karl spent some time in Agriculture working for both Seminis and Syngenta Flower. In these positions he worked on evaluating new varieties for commercial release and collecting data to produce growing information sheets on best nursery practices for newly released varieties. Since starting his Viticulture Advisor position last year Karl has assumed responsibility for rootstock evaluation projects looking at new nematode resistant rootstocks. It is hoped that this project will help identify better rootstocks for San Joaquin Valley growers. He is also interested at looking into groundwater recharge in vineyards to help with the implementation of the Sustainable Groundwater Management Act, and understanding the requirements and adjustments needed to fully mechanize local vineyards. Karl can be reached in his office at 559-675-7879 ext 7205, via email at ktlund@ucanr.edu, or by visiting the Madera Cooperative Extension at 338 South Madera Ave in Madera.

Dr Gabriel Torres is originally from Colombia where he obtained his bachelor's degree in Agronomy/Plant Science in 2007. He worked as a researcher at the Colombian National Oil Palm Research Center (Cenipalma) from 2007-2010. In 2010 he came to the US and started his Ph.D. program in Plant Pathology at Michigan State University, studying the worldwide distribution of the palm and coconut pathogen *Phytophthora palmivora*. Gabriel returned to Colombia in 2014 to lead the Oil Palm Diseases Program at Cenipalma for two years. After his graduation at MSU in 2016, Gabriel was invited by Dr. Andreas Westphal (UCR) to be part of his team conducting nematode research in grapes at the Kearney Agricultural Research and Extension Center.

Currently, Dr. Torres is working to refine integrated pest management practices for different pests and diseases of table grapes, including powdery mildew, nematodes, trunk diseases and sour rot. Recently, Gabriel joined the Fungicide Resistance Assessment, Mitigation and Extension Network (FRAME) to study fungicide resistance for Powdery mildew on table grapes, and currently is conducting a large field trial in collaboration with the USDA. Gabriel has also experience with electronics, and he is looking for automation of some equipment. Gabriel's office is located at the Tulare Cooperative Extension office 4437 South Laspina St Suite B in Tulare (Across from the International Ag Center). He can be reached by email at gabtorres@ucanr.edu or 559 684 3300.

Vit Tips Staff

Contributing Authors

Gabriel Torres, UCCE Viticulture Advisor Tulare & Kings Counties

559-684-3316, gabtorres@ucanr.edu

George Zhuang, UCCE Viticulture Advisor Fresno County

559-241-7515,

Karl Lund, UCCE Viticulture Advisor Madera, Merced & Mariposa Counties

559-675-7879 ext. 7205, ktlund@ucanr.edu

Editors

Matthew Fidelibus, UC Davis Viticultural Extension Specialist Kearney AG Center

559-646-6510, mwfidelibus@ucdavis.edu

Karl Lund, UCCE Viticulture Advisor Madera, Merced & Mariposa Counties

559-675-7879 ext. 7205, ktlund@ucanr.edu

Grapevine Heat Stress and Sunburn Management

George Zhuang, UCCE Fresno County

Heat waves are common in the San Joaquin Valley (SJV) during the end of the growing season in July and August. In 2017, grape growers in the SJV experienced two-to-three weeks with daily maximum temperature ≥ 110 °F. These conditions lead to severe water and heat stress resulting in yield loss and poor fruit quality for some growers. Berry sugar, organic acid, anthocyanins, and phenolics all can be negatively affected by extreme temperatures. Sugar accumulation can be slowed since leaf photosynthesis is lower when the canopy temperature passes 30 °C. Organic acid degrades faster under higher berry temperature as well as anthocyanins and phenolics. When the heat wave occurs, it usually also causes water stress. High daily temperature coupled with severe water stress will eventually reduce the berry size, reduce fruit quality and make the berry shrivel and raisin (Figure 1). Several vineyard design options (1 - 2) or cultural practices (3 - 6) can be adopted to help minimize the loss of yield and quality.

Figure 1. Berry shrivel, raisining, and sunburn during heat wave

1. Row orientation
2. Trellis selection
3. Leaf removal
4. Irrigation scheduling
5. Canopy shading
6. Canopy cooling

Row orientation should be optimized to have equal light exposure on both sides of the canopy is southeast to northwest with 45° angle. The traditional row orientation of raisin vineyard in the SJV of east to west is still good. While this row orientation was setup to allow raisins to be dried with southern exposure, it also works to minimize the direct light exposure cluster through canopy shading. North to south row orientation should be avoided for sunburn susceptible varieties, e.g., Muscat of Alexandria and Chardonnay because west-facing side of the trellis intercepts too much sunlight in the hottest part of the day.

Trellis selection is as important as row orientation. Trellis systems with a sprawling canopy are preferred under a hot climate, allowing the canopy to shade the fruit. Two-wire vertical trellis, or “California Sprawl”, is suitable for the SJV. Single high wire, quad high wire T top and Y trellis systems can all provide the required canopy shading on the clusters to prevent sunburn.

Figure 2. Mechanical leafing on morning side of the canopy at bloom

Leaf removal is applied to a canopy to provide enough light exposure and air circulation on fruit-zone without exposing the clusters too much direct sunlight. Hand or mechanical leafing (Figure 2) of the morning side of the canopy helps to avoid the afternoon sunlight exposure on fruit zone.

Proper irrigation management is critical to avoid excessive heat damage/water stress as well as berry sunburn. Severe deficit irrigation should be avoided before the heat wave to make sure vines are not excessively stressed during a heat wave. Soil moisture sensors, pressure chamber measurements, and close observation can help growers to assess soil moisture and vine water status. The grape ET report (https://ucanr.edu/sites/viticulture-fresno/Irrigation_Scheduling/) can help growers to decide the amount of irrigation per week to avoid severe grapevine water stress.

Figure 3. Shade cloth on fruit-zone at afternoon side of the canopy

Canopy shading including shade cloth (Figure 3) and sun protectant foliar sprays, e.g., Kaolin and $CaCO_3$ (Figure 4), can be used to reflect light away from the canopy and fruit in order to avoid excessive light exposure and sunburn. Cost and timing might be the most important factors when growers decide to use. Generally, the optimum timing to apply canopy shading is after berry set or several days before heat wave.


Figure 4. Sun protectant of $CaCO_3$ foliar spray post veraison

Canopy cooling can also be applied by in-canopy misting, but can pose a risk for disease management. Studies in Australia have found by in-canopy misting it can cool canopy and cluster, and ultimately improve yield and berry composition during heat waves (https://www.wineaustralia.com/research/search/completed-projects/ua-1502).

Chemical and biological control of grape nematodes in the San Joaquin Valley

By Gabriel Torres, UCCE Tulare & Kings Counties

Nematodes are microscopic roundworms. Nematodes that feed on plants are known as plant parasitic nematodes, and their feeding can cause significant yield loss.

Some species, such as the citrus nematode (*Tylechulus semipenetrans*) feed on a few specific plant species, whereas other species like the root knot nematode (*Meloidogyne incognita*) can feed on more than 150 different plant species. Several different nematode species can feed on the same plant, at the same time, further increasing the damage they may cause. Among the 22 genera of plant-parasitic nematodes, 10 have been reported to feed on grapevines.

There are two complementary strategies for nematode management: pre-planting and post-planting management. Pre-planting managements includes soil fumigation, anaerobic soil disinfestation (ASD) and rootstock selection. Post planting management includes both organic and conventional control methods. Cultural practices, such as preventing infested soil from moving from an infested vineyard to a non-infested vineyard by washing equipment, complement both strategies.

Nematode sampling prior to vineyard establishment is important. A sample should be taken for every 5-10 acres that has had a different cropping system, or different rootstocks in the past, and should also be separately collected for different soil types. Each one of these samples should consist of 1 quart (2 ¼ pounds) of soil collected from up to 24’’ inches in depth. After planting, nematode sampling, following a similar strategy, is recommended every 3 to 5 years. However, if a high population is identified and treated, a follow up sampling at the end of the growing season is recommended to determine the efficacy of the treatment. Table 1 shows the critical levels for different nematode species.

Anaerobic soil disinfestation consists of incorporating organic matter (such as rice hulls, molasses, or mustard meal) into the soil, then saturating the soil, and finally covering the soil with plastic for 4 to 6 weeks. The organic matter acts as a food source for soil microfauna to quickly reproduce. Along with reproducing soil microfauna, the saturated soil and plastic covering limit the amount of oxygen, ultimately resulting in an anaerobic environment within the soil profile. This environment is detrimental for organisms that require oxygen, such as nematodes, fungi, some bacteria, and plants. Fumigants also have a biocidal activity against wide range of organisms, but their use is limited by costs and environmental regulations.

After planting, fumigants and ASD are not viable, and chemical or biological measures are needed to control nematodes. In California, only the chemical active ingredients spirotetramat and imidacloprid are registered for grapes. Azadirachtin, Margosa oil, Myrothecium *verrucaria*, *Purpureocillium lilaciunum*, and Quillaja are registered as biological controls. Frequent monitoring and repeated use of these nematicides are required once nematodes populations are established.

When ASD and soil fumigation are not feasible, rootstocks resistant to local nematode populations are required. However, the use of resistant rootstock can also complement those techniques, resulting in a lower risk of develop higher nematode populations, and perhaps in a lower requirement of biological or chemical inputs for their management later during the lifespan of the vineyard.

To improve the efficacy of chemical nematicides they must be applied between budbreak and pre-bloom, or after harvest when the leaves are still active. Sprays during other phenological stages are not effective. It is also important to consider the risk of resistance development, especially when only two active ingredients are available for nematode control, and they are also widely used as insecticides for mealy bugs and other pests, adding to the selection pressure for resistance. Rotation of the active ingredients is advised to prolong the efficacy of these products. Biological nematicides may require more frequent applications to be efficient.

If you have questions, please contact your local farm advisor or your PCA.

Table 1
Nematode population sizes considered to be Low, Medium and High for a range of different nematode types and species at different times of the year. McKenry, 2013

	Nematodes present in 1 kg (2.2 lb) of Soil*					
Nematode	Low population		Medium population		High population	
	Oct-Mar	Mar-Oct	Oct-Mar	Mar-Oct	Oct-Mar	Mar-Oct
root knot	<75	<25	75-500	25-200	> 500	> 200
Xiphinema americanum	<20		20-200	20-100	>200	>100
Lesion	<20		20-100		>100	
citrus	<1000		1000-3000		>3000	
stubby root	<20		20-200		>200	
ring	<50		50-500		>500	
pin	< 100		100-1000		> 1000	
Xiphinema index	<20		20-200		>200	
needle	<20		20-200		> 200	
Helicotylenchus pseudorobustus	<50		50-500		>500	

Testing New Nematode Resistant Rootstocks

Karl Lund, UCCE Madera, Merced, & Mariposa Counties

Plant parasitic nematodes are a major concern for viticulture in the San Joaquin Valley (SJV). The sandy soils allow many different species of nematode to cause extensive damage to roots of grapevines that are not resistant to them. Nematodes that damage grape roots include root knot nematode *(Meloidogyne* spp.), dagger nematode *(Xiphinema* spp.), citrus nematode *(Tylenchulus semipenetrans),* lesion nematode *(Pratylenchus vulnus),* and ring nematode *(Mesocriconema xenoplax)*. In addition to direct damage, dagger nematode, especially *X. index*, can spread fan leaf viruses causing additional damage. Between direct damage and virus vectoring, nematodes can severely impact the health of a vineyard. It is estimated that root-knot nematodes alone can annually cause $1 billion US dollars in damage to vineyards within the US.

There are several options to protect against nematode damage. Prior to planting, vineyard soil can be fumigated or undergo anaerobic soil disinfestation (ASD) to kill the nematodes. After planting there are a handful of chemical and biological controls that can be implemented to control nematode populations within your vineyard. (These control measures are explored by Dr. Torres in another article in this issue.) An important option that should be used in coordination with other control strategies is the use of rootstocks that are resistant to the nematodes found at your vineyard site. Using a resistant rootstock helps protect the roots from damage, and can reduce the population of nematodes in your vineyard over time.

Several breeding programs have endeavored to develop new nematode-resistant rootstocks over the past 20 years. David Ramming of the USDA and Michael McKenry of UCR in California bred and selected RS-3 and RS-9 rootstocks, which were released in 2004, to be resistant to root-knot nematode. Andrew Walker of UC Davis bred and released five rootstocks (GRN 1, 2, 3, 4, and 5). These rootstocks were bred and selected to be resistant to dagger and root-knot nematodes, though they have some resistance to other nematode species as well. Table 1 compares nematode population levels on these new rootstocks with several common rootstocks under greenhouse conditions. Rootstocks that support large populations of nematodes can be a sign of susceptibility or a sign of tolerance. A tolerant plant-pest interaction allows for a pest to reproduce, possibly to large population sizes, while showing little to no loss of economic productivity of the plant.

Dr. Peter Cousins, formerly of the USDA-ARS program in Geneva, NY, spent more than a decade breeding root-knot resistant rootstocks. Selections from his program are still being evaluated. There is limited information on the performance of vines grafted to Peter Counsins' (PC) rootstocks, or to the rootstocks released by the USDA and US Davis. Other rootstock selections have been shown to affect vine growth and yields, nutrition status and fertilization efficacy, as well as berry characteristics and fruit chemistry. Before these rootstocks can be widely adopted for use in the San Joaquin Valley, it is important to understand what effects these nematode resistant rootstocks have on the scion.

To begin answering these questions a large rootstock trial has been setup in Northern Merced County.

Image 1
Surviving GRN-5 uprooted with developed root system prior to replanting (left).
Deceased GRN-5 uprooted with very little or no root development (right).

The trial was planted with Malbec winegrapes grafted to 1103P, RS3, RS9, GRN2, GRN3, GRN4, or GRN5 rootstocks. Most of the vines grafted to GRN5 did not survive their first full year in the field. After a count of the survivors it was found that only 18% of the vines on GRN5 were still alive. An inspection of the dead plants found that they had little to no root development (Image 1). Due to this high loss rate, GRN5 was removed from the trial. This is the second trial conducted in the San Joaquin Valley where GRN5 has suffered major losses in the first year, and needed to be removed from data collection. While it is unknown if the previous losses were due to the same issue, the high loss rate in multiple trials raises questions as to the viability of this rootstock.

The remaining rootstocks all grew vigorously and received multiple training passes during the 2018 growing season. Growth of the vines, measured through trunk diameter, showed no differences after the 2018 growing season (Table 2). As the plants were still young the decision was made to encourage additional growth by dropping the crop at veraison, so no yield or fruit quality data were collected in 2018. However, in addition to the growth data, nutrient data was also collected giving some basic insights into the differences between these rootstocks.

Table 2
Trunk diameter of commercially available rootstocks measured after the 2018 growing season.

Rootstock	Ave Diameter (mm)	Ave Diameter (inch)
1103P	17.03	0.67
RS3	17.68	0.70
RS9	17.76	0.70
GRN2C	18.54	0.73
GRN3C	17.76	0.70
GRN4C	16.77	0.66

Vine nutritional status was taken at both bloom and veraison in 2018 to look at the differences in rootstock uptake of nutrients. At bloom, potassium (K), zinc (Zn), sodium (Na), boron (B), calcium (Ca), magnesium (Mg), copper (Cu), and chloride (Cl) all showed statistical differences in petiole concentrations (Table 3). At veraison, potassium (K), manganese (Mn), calcium (Ca), magnesium (Mg), and Chloride (Cl) all show differences in petiole concentrations (Table 4). Nitrogen (N), phosphorus (P), and iron (Fe) showed no difference at either timepoint. Nitrogen and phosphorus are two of the plant nutrients needed in highest quantity for the plant's metabolism. The fact that there is no difference between the new rootstocks and the standard 1103P is valuable information for both nutrients. This is especially valuable for nitrogen where vineyard manager can continue with their standard nutrient management practices.

The trialed rootstocks showed consistently different uptake patterns for three nutrients: potassium (K), calcium (Ca), and Magnesium (Mg) (Table 3 & Table 4). Potassium and calcium concentrations were higher in vines grafted to the GRN rootstocks as compared to RS-3, RS-9 and 1103P. Magnesium shows the exact opposite effect with the GRN rootstocks having lower concentrations than RS-3, RS-9 and 1103P. Potassium plays a vital role in stomatal conductance during the growing season, allowing the plant to control carbon assimilation and water loss. Potassium has also been shown to play a role in berry pH. The extra potassium taken up by the GRN rootstocks may lead to issue with low acid levels, especially in vineyards with consistently high pH. As fruit chemistry has not yet been collected, it is unclear if the differences in petiole nutrient concentration will affect berry nutrient concentrations. Calcium is normally not an issue in the San Joaquin Valley, so differences in uptake should not affect local growers. Magnesium deficiencies do occur in the SJV, so the decreased uptake in the GRN rootstocks may need to be monitored in vineyards where Magnesium deficiencies have previously been observed.

The rootstocks also showed differences in their ability to uptake (or exclude) chloride (Cl-) from the scions at both bloom (Table 3) and veraison (Table 4). At bloom GRN-2, RS-3 and RS-9 had the highest concentrations. However, by veraison GRN-2 still had the highest concentration, while RS-3 and RS-9 had the lowest concentration. Chloride can be a problem in some local areas, especially where irrigation water is of lower quality. Therefore, the higher uptake of chloride by GRN-2 may be an issue. However, these concentrations are still well below any level that would be cause for concern. It would be advised to test GRN-2, and all the other new rootstocks, under chloride (and general salt stress) before use in such areas.

A second smaller trial was also established in this vineyard, comparing six PC rootstock selections. The selections were planted as ungrafted vines in a single row just east of the main trial. The vines were field grafted to Malbec in spring of 2019, so data collection has yet to begin on the grafted vines. Prior to grafting trunk diameters (Table 5) did differ between the rootstocks. This may be an early indication of vigor differences between these different stocks.

Table 5
Trunk diameter of Peter Cousins' (PC) rootstocks that show statistical differences at P<0.01. Means separation was done using Duncan multiple range test. Means with the same letter after the average cannot be statistically separated

Rootstock	Ave Diameter (mm)
PC 0333-5	15.42 A
PC 04153-4	13.60 AB
PC 0349-11	12.73 AB
PC 0597-13	12.26 AB
PC 0349-30	10.01 B
PC 0495-51	9.49 B

Table 1
Population level supported by the root system of current, and newly released nematode resistant rootstocks. Population assessed relative to nematode reproduction on cv Colombard. V.(ery) Small < 10% population on Colombard, Small 10-30% population on Colombard, Medium 30-50% population on Colombard, Large >50% population on Colombard (edited from Ferris et al., 2012).

Genotype	***M. incognita Race 3***	***M. javanica***	***M. pathotypes Harmony A&C***	***M. chitwoodi***	***X. index***	***M. xenoplax***	***P. vulnus***	***T. semipenetrans***	***Para. hamatus***
Nematode Type	**Root-knot Nematode**	**Root-knot Nematode**	**Root-knot Nematode**	**Root-knot Nematode**	**Dagger Nematode**	**Ring Nematode**	**Lesion Nematode**	**Citrus Nematode**	**Pin Nematode**
1103 Paulsen			Large		Large	Large	Medium		Large
Ramsey	V. Small	V. Small	Large	Large	Small	Large	Medium	Medium	Large
Freedom	V. Small	V. Small	Large	Large	V. Small	Medium	Medium	Large	Small
RS-3	V. Small	V. Small	Small	Small	Large	Large	Small		Large
RS-9	V. Small	V. Small	V. Small	V. Small	Large	Large	Medium		Large
UCD GRN1	V. Small		V. Small		V. Small	Very Small	Small	V. Small	Small
UCD GRN2	V. Small		V. Small		V. Small	Medium	Small	Medium	Small
UCD GRN3	V. Small		V. Small		V. Small	Small	Small	Small	Small
UCD GRN4	V. Small		V. Small		V. Small	Small	Small	Small	Medium
UCD GRN5	V. Small		V. Small		V. Small	V. Small	Small	Small	Small

Table 3

Results of petiole nutrient samples taken at Bloom. Potassium (K), sodium (Na), and chloride (Cl) show statistical differences at P<0.05, while zinc (Zn), boron (B), calcium (Ca), magnesium (Mg), and copper (Cu) show statistical differences at P<0.01. Means separation was done using Duncan multiple range test. Means with the same letter after the average cannot be statistically separated

Rootstock	N (ppm)	P (%)	K (%)	Zn (ppm)	Mn (ppm)	Na (%)	B (ppm)	Ca (%)	Mg (%)	Fe (ppm)	Cu (ppm)	Cl (%)
1103P	2348	0.46	1.79 ABC	41 C	163	0.01 B	45 A	2.69 C	0.90 B	52	12 B	0.1 B
GRN2C	2595	0.44	2.17 A	45 C	130	0.02 A	45 A	3.70 A	0.57 C	64	12 B	0.2 A
GRN3C	1933	0.47	1.92 AB	46 C	118	0.02 A	42 A	3.16 B	0.61 C	65	9 C	0.2 AB
GRN4C	2175	0.47	1.85 AB	49 BC	180	0.02 A	43 A	3.27 AB	0.62 C	64	10 BC	0.2 AB
RS3	2725	0.49	1.33 C	64 A	168	0.02 A	38 B	2.39 C	1.10 A	65	14 A	0.2 A
RS9	2518	0.48	1.45 BC	56 AB	162	0.02 A	39 B	2.26 C	1.04 AB	61	14 A	0.2 A
Prob.	0.096	0.387	0.015	<0.001	0.074	0.035	0.001	<0.001	<0.001	0.621	<0.001	0.046

Table 4

Results of petiole nutrient samples taken at Veraison. Potassium (K), manganese (Mn), calcium (Ca), magnesium (Mg), and Chloride (Cl) all show statistical differences at P<0.01. Means separation was done using Duncan multiple range test. Means with the same letter after the average cannot be statistically separated

Rootstock	N (ppm)	P (%)	K (%)	Zn (ppm)	Mn (ppm)	Na (%)	B (ppm)	Ca (%)	Mg (%)	Fe (ppm)	Cu (ppm)	Cl (%)
1103P	438	0.58	1.54 B	45	383 A	0.01	37	2.47 A	1.38 A	38	4	0.35 BC
GRN2C	433	0.43	2.53 A	39	281 BCD	0.01	39	2.87 A	0.73 E	30	3	0.50 A
GRN3C	296	0.46	2.44 A	38	297 BC	0.00	38	2.64 A	0.90 D	35	3	0.35 BC
GRN4C	355	0.47	2.19 A	37	318 B	0.01	37	2.83 A	0.98 CD	47	3	0.40 AB
RS3	497	0.47	1.43 B	45	235 D	0.00	37	2.02 B	1.14 BC	41	4	0.28 CD
RS9	450	0.50	1.26 B	41	244 CD	0.00	35	2.01 B	1.17 B	33	4	0.20 D
Prob.	0.480	0.098	<.001	0.391	<.001	0.164	0.509	<.001	<.001	0.299	0.157	<.001

Save the Date!

2020 San Joaquin Valley Grape Symposium

Wednesday, January 8, C.P.D.E.S Hall, Easton CA

Grape Symposium is sponsored by RBA and Sun-Maid

Agenda and registration will be available soon!

Sensor Technology Workshop
Hosted by NGRA and USDA ARS
November 13, 2019 in Sacramento
Agenda and registration:
https://graperesearch.org/events/ngra-ars-sensor-technology-workshop-2019/

SWEEP Update

Shulamit Shroder and Alli Rowe

The California Department of Food and Agriculture's State Water Efficiency and Enhancement Program provides grant funding to producers to help improve their water use efficiency and decrease their greenhouse gas emissions. It funds practices such as:

- Installation of variable frequency drive
- Pump conversion from diesel to electric or solar
- Pump retrofit or replacement
- Soil moisture monitors
- Use of evapotranspiration-based irrigation scheduling
- Conversion to micro irrigation or drip irrigation
- Conversion to low pressure irrigation system

SWEEP will solicit applications for the next round of funding towards the end of 2019. The grant portal should open up again in **November or December**. In the meantime, interested growers can:

- Review the most recent Request for Grant Applications: https://www.cdfa.ca.gov/oefi/sweep/docs/2018_SWEEP_RGA.pdf
- Create a project design and list the practices they want to implement
    - Find ideas on page 34 of the Request for Grant Applications
- Get quotes for items needed for the project, itemized and with labor included
- Get a pump efficiency test for all the pumps that will be affected by the project
- Get 12 months of energy use data for pumps (e.g. energy bills or fuel receipts)
- Schedule time to talk to a technical advisor – Shulamit Shroder at UCCE Kern, sashroder@ucanr.edu or Tulare Resource Conservation District, teri@tularecountyrcd.com

University of California
Cooperative Extension
Tulare County
4437-B South Laspina Street
Tulare, California 93274

Nonprofit Org
US Postage Paid
Visalia, CA 93277
Permit No. 240

Vit Tips

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Gabriel Torres
Viticulture Farm Advisor