VIT TIPS

San Joaquin Valley Viticulture Newsletter

UC CE University of California Agriculture and Natural Resources Cooperative Extension

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Tips to Maintain Table Grape Quality During Postharvest Storage

Ashraf El-Kereamy, UCCE Kern County

Table grape markets require a high quality grape with a superior appearance. Therefore, producing high quality grapes should be followed by good postharvest handling and storage to ensure that the grapes reach the final customer in very good condition. This can be achieved by minimizing the deterioration rate of the grapes during harvest, transportation and storage. Inappropriate harvest, handling, and storage of grapes may reduce fruit quality and limit its marketability.

Fruits are classified into two major groups depending on their physiology during ripening and postharvest. The first type are climacteric fruits which continue to ripen after harvest. The second type are non-climacteric fruits where the fruit will stop ripening upon harvest. Grapes are non-climacteric fruits and do not ripen any more after harvest. Because grape quality will not improve after harvest, grapes should meet desired quality standards before harvest.

The rate of metabolic processes involved in postharvest fruit deterioration is correlated with fruit temperature. Grapes are exposed to high temperatures on the vine, during maturation, and during harvest, packing, and transportation to cold storage facilities. Together, these sources of heat contribute to "field temperature," which must be accounted for during grape precooling before storage. However, the exposure of the grapes to high temperatures for a long time before precooling can result in non-reversible damage despite precooling. Therefore, maintenance of grape quality during postharvest depends on minimizing the exposure of grapes to direct sunlight in the field, prior to precooling, and removing the heat accumulated by grapes prior to cold storage or cold transportation. Another benefit of precooling is to prevent condensation around the grapes during storage due to the difference in the temperature between grape and the storage environment.

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In This Issue

Pictured: Table grapes in cold storage (Photo by UCANR)

Upcoming Events

UCCE Seminar: Vineyard Pest and Disease Management

November 4, 2016
9:00 am—3:00 pm
Veterans Memorial Building
801 Grand Ave.
San Luis Obispo, CA
Approved for 4.5 hours DPR CE units.
Advanced registration is required.
Registration, agenda, and further information is available at
http://ucanr.edu/ucceviticulture

Continuing Education Series for Pest Management Professionals

Every Tuesday from 8:00 am—12:00 pm
Starting October 11 through November 8, 2016
2145 Wardrobe Ave.
Merced, CA
Further information and registration can be found at http://cemerced.ucanr.edu/Continuing_Education_for_Pest_Management
The agenda is available at
http://cemerced.ucanr.edu/files/154077.pdf

UC Davis Department of Viticulture and Enology On the Road Series

November 16, 2016
8:15 am—1:30 pm
Hampton Inn and Suites
3254 Airport Dr.
Madera, CA
Light breakfast and lunch included with registration.
Registration and additional information is available at
http://ucanr.edu/survey/survey.cfm?surveynumber=19093

2017 San Joaquin Valley Grape Symposium

January 11, 2017
7:00 am - 12:00 pm
C.P.D.E.S. Hall
172 W. Jefferson Avenue
Fresno, California
Registration, agenda, and further information is available at
http://ucanr.edu/survey/survey.cfm?surveynumber=19024

Brief Survey for Table Grape Growers

Grapevine trunk diseases cause millions of dollars of revenue loss to the CA grape industry each year. These diseases have been studied in wine grape production systems, but research remains limited in scope for table grape production. In addition to yield loss and reduced vineyard longevity, these diseases can blemish berries which negatively impacts fruit marketability.

The survey linked below will provide a starting point to assess the economic impact of trunk diseases in California table grape production systems.

If you are in table grape production, please fill out this brief survey here:

http://ucanr.edu/survey/survey.cfm?surveynumber=7770

Grape Maturity and Raisin Quality

Matthew Fidelibus, UC Davis Viticulture & Enology

Raisins are 70 to 80% sugar, on a dry-weight basis, so the sugar content of fresh grapes at drying has a strong impact on raisin quality and yield. Raisins made from immature grapes will lack bulk and have a flattened, angular appearance, with deep, thin, wrinkles. In contrast, raisins made from fully mature grapes are bulky, with a rounded shape and numerous fine wrinkles, or shallow wrinkles with thickened edges. L. Peter Christensen clearly showed the impact of fruit maturation, over a three-week period from late August through mid-September, on raisin yield and quality. For each week that drying was delayed, grape soluble solids increased by approximately 1 °Brix, raisin "B and better" grades increased 11.5%, and yields increased about 450 lbs per acre. Similar results have been observed in other studies and, of course, raisin growers have extensive first-hand experience in observing the relationships between fruit maturity and raisin yield and quality. Despite the well-established and well-known relationship between grape maturity and raisin quality, raisins sometimes fail to achieve expected quality grades, as was the case last year for some growers.

There are several possible explanations that could help account for lower than expected raisin quality. A common mistake is making harvest decisions based on a berry sample that is not representative of the vineyard. Lindsay Jordan described how to go about collecting representative berry samples in an article published in a previous issue of Vit Tips (http://tinyurl.com/zkv3kbc). In her article, she stresses the importance of considering vineyard variability when sampling. Carter Clary, former scientist at CSU Fresno, showed that the percent substandard raisins from a vineyard is influenced by the average soluble solids of the fresh grapes and the variability of soluble solids. In other words, vineyards whose grapes span a wide range of soluble solids will tend to produce more substandard raisins than vineyards with a low range of soluble solids even if fruit from the two vineyards have the same average Brix.

If your raisin quality has been lower than expected and you are confident of your berry sampling methods, consider berry size. Berry size also affects raisin quality; raisins made from large berries generally grade better than raisins made from small berries if soluble solids are the same for both sizes of grape. In fact, the main potential benefit of using gibberellic acid on Thompson Seedless raisin grapes is to improve raisin grades by increasing berry size without reducing soluble solids. Some growers have had to deal with water limitations in the last few years, and continued irrigation deficits could limit berry size, possibly reducing raisin yields and grades.

Pictured: Studies have found that by allowing fruit to mature longer and therefore accumulate more sugar, yields and raisin "B and better" grades increased. (Photo by UCANR)

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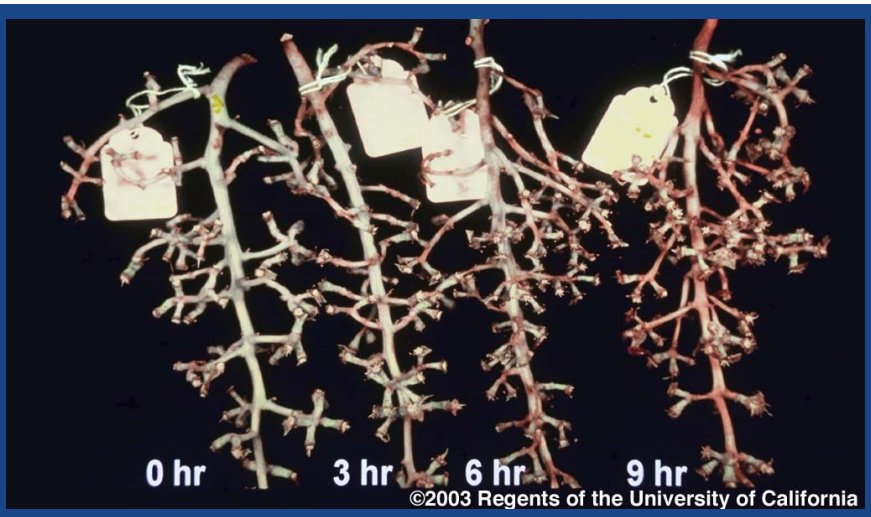
Exposure of grapes to high temperatures for a few hours before precooling could cause a physiological disorder and significantly reduce their quality. There are many studies illustrating the effect of environmental conditions during ripening and harvest on the storability and quality of grapes after harvest. One of the old but useful studies is the one published by Nelson in 1956 (The Blue Anchor, Vol. 32, No. 2). In this two-year study, Nelson showed that the exposure of Tokay grapes to 100ºF up to 6 hours before precooling increased stem dryness, browning and berry softness compared to exposure to 70ºF. In fact, he found more brown stems in the fruit held at 100ºF for 2 hours than those that were held at 70ºF for 8 hours before precooling, illustrating the strong negative effects of high temperatures. In this study, the author and his collaborators also showed that the temperature of grapes exposed to direct sunlight was 11ºF higher than air temperature; in contrast, the temperature of grapes kept in a shaded area was 6ºF below air temperature. This effect will depend on several factors such as the variety, the time of the year, and the quality of the grapes. However, in general, exposure of grapes to high temperatures up to 100ºF for up to six hours will accelerate the rate of grape deterioration and result in undesirable effects including, but not limited to:

- Dry stems
- Brown stems
- Soft berries
- Berry shatter

We all know that choosing when to harvest is an important decision and requires a lot of planning, especially due to manual hand harvest and the need for trained labor. However, it is very important to consider the following:

- When possible, avoid harvest during exceptionally hot weather.
- Do not harvest when the fruit is wet due to rain or from dew, since the wet fruit has a higher risk of infection and quality loss.
- Reduce the indirect and direct exposure of fruit to sunlight by removing it as soon as possible from the field to the precooling facility.
- Keep harvested and packed fruit in a shaded area if transport is not available immediately.
- Remember that every minute counts from picking to precooling.
- The box should allow rapid cooling of grapes and check the permeability of plastic bags to respiratory gases.
- Eliminate any damaged or infected grapes that might increase the risk of post-harvest spoilage.



Pictured: Cumulative water loss during postharvest handling results in stem browning. (Photo by UCANR)

Vines to Wines: Understanding pH and Acidity

Lindsay Jordan, UCCE Madera, Merced, & Mariposa Counties

How do pH and Acidity Interact?

There are many aspects of fruit quality that can create problems in the winery. Typically, we are using measures of sugar and acidity and to help determine when to pick wine grapes and what extra steps may need to be taken in the winery in order to create a stable, quality product. When measuring acidity, there is both titratable acidity (TA) and pH to consider. Sometimes, a problem juice may have a high pH value, accompanied by a high TA value. By understanding some of the chemistry of the acids within grape juice, the high TA/high pH problem can be explained.

As explained in a previous Vit Tips newsletter article, (which can be found here: http://ucanr.edu/sites/viticulture-fresno/newsletters_819/?newsitem=59656) to measure TA, we take a known volume of juice, and add a basic solution, typically sodium hydroxide, until it reaches a specific pH endpoint. By doing so, we are adding OH^- anions to the juice, which react with the available hydrogen ions in the acid rich juice. The more hydrogen ions that are present, the more OH^- anions are needed to get to the end point. From the amount of base added, a simple equation can be used to calculate the titratable acidity. TA is important because it estimates total acidity, and helps us understand the amount of tartaric and malic and other acids that will contribute to sour flavor, mouth feel, and other sensory aspects of the juice and wine.

Meanwhile, pH is a measure of acidity as well – but it is a The resulting value on the pH scale indicates how acidic (with many H^+ ions and a <7 value) or basic (few free H^+ ions with a >7 value), a solution may be. When using pH, it is important to realize the scale is logarithmic, meaning that the concentration of H^+ ions is increasing exponentially with each whole number on the pH scale. For example, a solution with a pH of 4 has a tenfold difference in the number of H^+ ions than a solution with a pH of 3. Because of this, even small differences in pH can have a large influence on pH dependent reactions that take place during berry development or winemaking.

When dealing with grape juice, pH values are in the acidic range, typically between 2.5 (like in unripe green berries or fruit harvested very early) and 4.5 (like in juice from warm climates with naturally low-acid varieties).

For winemakers, pH is a critical factor to consider. The pH value is important for microbial stability, ensuring the environment is acidic enough to discourage the growth of unwanted microbes. For reds, the perception of color is highly dependent on pH, and high pH values contribute to reduced color stability and negative taste perceptions. Knowing that pH is important in winemaking, it is important to consider when there is an undesirably high pH of a grape juice sample. Winemakers may need to acidify a high pH juice to achieve a desirable pH level for microbial and color stability with value. However, this can be a problem when there is already a high TA value, since additional acid could make a wine excessively sour.

While both relate to the acidity of juice or wine, TA is not the same thing as pH, and there is no constant, predictable relationship between the two measures. Under the right conditions, it is possible to get juice with a high TA, but also a high pH. By understanding what conditions contribute to the high TA/high pH scenario, grape growers can aim to avoid this situation in the winery.

Potassium is Involved

When TA and pH are both high values, it can be because H^+ ions and acids are not alone in grape juice. There are other ions – like potassium (K^+) ions – that are initially taken up through the roots via the xylem, and then moved throughout the vine via the phloem. There is a balance between the different forms of acids in the juice solution and K^+ ions will effect this balance. Increased K^+ ions contribute to an elevated pH.

Excessive potassium fertilization should be avoided and regular soil and petiole tests should be used to make fertilization decisions. Check out the previous Vit Tips article for information on potassium in the vineyard (http://ucanr.edu/sites/viticulture-fresno/newsletters_819/?newsitem=63705).

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There are also some recently published blog posts from my extension colleagues at Penn State about managing potassium in the vineyard (https://psuwineandgrapes.wordpress.com/2016/09/16/assessing-and-managing-potassium-concentration-in-the-vineyard) and during winemaking (https://psuwineandgrapes.wordpress.com/2016/09/23/making-red-wine-from-fruit-high-in-potassium/) that thoroughly discuss the complexities of managing potassium.

If a newly planted vineyard site has elevated levels of potassium and the fruit has high TAs with too high pH values, potassium values should decline as fruit is removed from the vineyard.

Some rootstocks are known for greater potassium uptake, such as the Freedom rootstock. If the problem is severe, when the site is replanted, an alterative rootstock that naturally has lower potassium uptake could be considered. However, rootstocks can effect the vigor and yields of a grape vineyard, and the economic impact of lower fruit quality should be weighed against any potential loss in yields from using a less vigorous rootstock.

However, as a side note, the greater potassium uptake that sometimes leads winemakers to dislike the Freedom rootstock should not be confused with vineyard management decisions that lead to excessive vigor and lower fruit quality. Excessive vigor and shading in grape canopies shading is associated with greater potassium transport to the fruit. This potassium transport is associated with a loss of H^+ ions and higher pH levels with any rootstock. The uptake of potassium is just one factor to consider in rootstock selection and will just be one aspect of the resulting fruit quality.

Acidity will decline after veraison, but pH and K increase

After veraison, acidity will decline in the fruit over time as malic acid is respired, while tartaric acid remains relatively constant, and pH will increase. It is also important to note potassium uptake will continue through the season, from before veraison until the fruit is harvested, with potassium accumulating within the skin, flesh, and seeds of the grape berries. If cool conditions or other factors meant that malic acid respiration was reduced, high TA values would be maintained, while the increased potassium uptake would result in a high pH value.

Consistent tracking of both TA and pH values can help time harvest decisions to get the best possible TA/pH values.

Studies have shown that petioles and fruit with high potassium values at veraison also had high potassium values at maturity. Investing in tissue tests can reveal when high potassium values are present, and therefore signal when the potential for an undesirable high TA/pH situation may be likely.

Ultimately, it will be the balance of vineyard management, rootstock and variety selection, and seasonal conditions that will contribute to the balance between TA and pH. As grape growers, by understanding the chemistry and understanding why these values matter in the winery, we can aim to grow the best quality fruit – and ultimately wine - possible.

Pictured: There are many things that can influence the perception of a wine's color, including pH. (Photo by UCANR)

Nematode Problems in Vineyards

Andreas Westphal, UC Riverside Dept. of Nematology

Many Central Valley crops are under attack by plant-parasitic nematodes. These microscopic roundworms depend on the soil environment to regulate their activities. Nematodes are too small to regulate their body temperature but warm California soils are highly supportive of their development. This requires producers to be vigilant in managing these pests.

Management options can be divided into pre-plant and post-plant decisions. Pre-plant decisions will strongly impact the productivity and longevity of a new vineyard. A producer will need to consider at least the following aspects: What is the crop history of the field? What is the soil texture and profile? What rootstock will be planted?

The most obvious challenge is probably when grapes follow grapes in light soils. It should be a straight-forward concept that nematode populations left from the previous crop will need to be considered when making vineyard renovation decisions.

It is probably less obvious that the potential for nematode problems also exists when grapes follow annual crops. For example, there could be problems with infestations of root-knot nematodes (RKN; *Meloidogyne* spp.). Members of this genus have wide host ranges and many species can infect grapes. Many vegetable and field crops can support populations of this nematode. Sometimes infestations will not be noted in those annual crops, and yet they could cause damage to grapes.

Of course, the soil texture of a field cannot be changed but it has profound impacts on the nematode problems to expect. For example, sandy soils typically allow for high reproduction and damage by ring nematodes. In comparison, root-knot nematodes can be quite damaging in many agricultural soils, and only very heavy soils with limited secondary structure have less risk of RKN infestations.

Another important point is that plant-parasitic nematodes often occur in patches of any given field. Many factors contribute to this pattern, including slight soil texture differences, differences in soil microbial populations, tillage direction, and other field operations.

This is critical background information when producers make their nematode sampling and resulting management decisions. When sampling, soil strata need to be considered. In general, areas of similar soil texture and crop history should be grouped. For example, a sandy area of a field should be sampled separately from the heavy areas. In this stratification approach and depending on feasibility, areas no larger than 2-5 acres should be represented with at least one sample.

Once a given field is stratified, the clumped distribution of the nematodes needs to be considered. Any given area should have at least 10 subsamples. Many field researchers would attest that higher numbers of subsamples will be preferable, but the process needs to remain feasible.

A frequently discussed topic is sampling depth. Many commercial laboratories offer their sampling services to 18-inch depth. Presumably, in most instances this may be sufficient. But plant-parasitic nematodes can occur at their highest population densities three to four feet deep. Especially when a field has been fallowed for extended time periods, populations in the dried out surface may have declined at the time of sampling, so deeper sampling is needed in order not to miss a nematode infestation.

Nematodes are obligate parasites, so they will be found most frequently in the root zone of their host plants. If the old vineyard is still in existence when the sampling is done it is preferable to collect samples from the irrigated area where most roots are expected to be. This will vary between drip, furrow, and flood irrigated vineyards. While roots will be most prevalent in the "irrigation halo" in drip irrigated vineyards, they likely will be more widely distributed in flood-irrigated grape plantings and probably be included in some of the row middles. The nematodes will be detected wherever there are roots. In fallow fields, sampling should focus in areas where the previous root growth is expected to have been located.

Once soil is taken from the ground, it needs to be kept out of the sun and heat as much as reasonably possible. For example when sampling at two depths (0 -1 ft and 1-2 ft depth), soil from these depths should be collected separately per depth layer while collecting from the different locations within the sampling areas, and at completion thoroughly mixed per depth layer.

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A sample representing the different depth layers is then taken from this composite. Typically, about a quart of soil is placed into a bag and immediately stored in an ice chest to remove it from sun exposure in very hot weather. This is done because a sealed clear plastic bag can heat up in the sun very quickly. As plant-parasitic nematodes are sensitive to heating, such direct exposure would kill them and make them non-extractable in the following laboratory procedures.

In the laboratory, there are various options to extract the nematodes. Based on field history and the other parameters mentioned in this article, various nematodes will be expected. As a rule of thumb, if more species that live in the soil are expected, methods aiming at their extraction, e.g. density flotation/centrifugation methods, should be used. When suspecting mostly nematodes closely associated with the roots, sieve-mist extraction is preferred as it specifically aims at extracting such species. The producer can give the laboratory invaluable guidance on how to proceed with soil samples by providing a synopsis of the field history. At the very least, the extraction method should be stated in the report to allow for proper interpretation of the results.

The key nematodes to consider when examining soil extraction results include: root-knot nematodes (*Meloidogyne* spp.), ring nematode (*Mesocriconema xenoplax*), citrus nematode (*Tylenchulus semipenetrans*), dagger nematode (*Xiphinema americanum, X. index*), and others.

Once the data is reported, the producer can make soil treatment and rootstock decisions. Soil fumigation may be warranted to reduce high nematode numbers. It needs to be understood however, that a complete eradication of nematodes in perennials for the lifespan of a vineyard is unrealistic. So, if high population densities of particular plant-parasitic nematodes are reported for a given field, double the care should be given in the rootstock choice. Despite the initial benefit following soil treatment, a particularly susceptible and sensitive rootstock is somewhat likely to have problems later in the life of the vineyard. At this stage it is advisable to seek help from your farm advisor who will have information on local performance of distinct rootstocks.

Many crops can benefit from zone treatments against soil-borne pests. It seems tempting to do something like this in grape as well. The decision maker needs to be aware that, for example, a strip treatment greatly reduces the protective time compared to a solid treatment. Especially in fairly narrow row-spaced vineyards, a clear reasoning needs to be weighed between cost savings and the longevity of nematode suppression.

Currently, there is not as much cover cropping in vineyards in the southern part of the Central Valley as other regions. Some of the cover crop mixes may have beneficial effects in reducing nematode population densities and improving other biotic and abiotic properties of the soil. The perceived need of water for such crops and the established need for vineyard cleanliness from weeds are some of the factors to consider for a cover crop strategy.

In summary, plant-parasitic nematodes constitute a complex problem that will be continual in vineyards. The decision making process starts with a well conducted soil sampling regimen and needs to take advantage of the information available on rootstock material. For further reading, the UC IPM guidelines are an important source of information.

More information can be found at UC IPM Pest Management Guidelines Grape Nematodes found at http://ipm.ucanr.edu/PMG/r302200111.html.

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Contact your local viticulture farm advisor or UCCE county office to be added to the e-mailing list or if you wish to receive a mailed copy.

Questions? Concerns? Follow up? Please feel free to contact us.

Ashraf El-Kereamy
UCCE Kern County
661-868-6226
aelkereamy@ucanr.edu
@ashrafelkereamy

Allison Ferry-Abee
UCCE Tulare and Kings Counties
559-684-3316
aeferry@ucanr.edu
@GrapevineAbee

George Zhuang
UCCE Fresno County
559-241-7506
gzhuang@ucanr.edu
@ZhuangGeorge

Lindsay Jordan
UCCE Madera, Merced & Mariposa Counties
559-675-7879 ext. 7205
lmjordan@ucanr.edu
@LJtheGrape

Matthew Fidelibus
UC Davis Dept. of Viticulture and Enology
559-646-6510
mwfidelibus@ucanr.edu
@grapetweets

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