University of California Cooperative Extension

Grape Notes

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Division of Agriculture & Natural Resources

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Vine mealybug update

Vine mealybug has now been found in the majority of the grape-growing counties in California. 2003 saw a significant increase in the number of infestations found in the state over the previous year, and there is no reason to think that 2004 will be any different. Considering the large number of infested acres in the San Joaquin Valley, it seems likely that we will be dealing with introductions of the pest onto the Central Coast for the foreseeable future. By maintaining our awareness of the pest and our efforts to find any new infestations as early as possible, we can keep the vine mealybug from ever becoming a major economic threat here.

Every vineyard in this area is susceptible to this pest. Our efforts to locate infestations in previous years focused on younger plantings, due to the apparent association with contaminated nursery stock. Now we may be entering into a phase of secondary infestations, where the pest is moved from one commercial vineyard to another, on vectors such as mechanical harvesters, field crews, birds, and the movement of contaminated grapes.

Pheromone traps should be a fundamental part of your vine mealybug program. They can help you find infestations while they are still on a small scale, greatly

UCCE Meeting Announcements

Fundamentals of vineyard water management

Free seminars sponsored by UCCE will cover the topics of ET measurements, irrigation scheduling, soil moisture monitoring, plant-based monitoring, salinity management, and irrigation system performance evaluation.

Los Alamos, April 21, 2004

- 9 am – 11 am
- Los Alamos Men's Club Meeting Room
- 429 Leslie (across from the fire station)

Paso Robles, April 23, 2004

- 9 am – 11 am
- Paso Robles Library Conference Room
- 1000 Spring Street, Paso Robles

Please RSVP at (805) 781-5940 to sign up for either meeting

increasing the likelihood of successful eradication. The cost of trapping is miniscule when compared to the treatment costs of a heavy infestation. The pheromone traps only attract the flying males, which do not themselves damage the vines. We still do not have a good understanding of how the male vine mealybug population varies throughout the season; the highest numbers will be found later in the season near harvest, corresponding to the higher numbers of females on the vines. However, there is likely enough mealybug activity soon after budbreak to warrant having traps in place; also, if males are found early, treatments can begin while the population is still relatively small. Trapping should continue until after harvest when the vines go dormant.

As a general rule, use one trap per 20 acres. Dirty traps are very difficult to evaluate; keep traps clean by using two large paperclips to secure the folded ends of the trap. If you do find males on a trap, increase the trap density in that area to help pinpoint the location of the infestation. For positive identification of suspect males on the traps, bring them into your local Ag Commissioner office. A guideline for evaluating the traps can also be downloaded at:

http://ucce.ucdavis.edu/files/filelibrary/1198/10997.pdf

Pheromone traps are available at no charge while supplies last through this office. Please help with the statewide mapping project by providing your trapping results (both negative and positive, by location) at the end of the season.

Educating your field workers so that they can recognize and report any suspect infestations is crucial. To assist your education efforts, bilingual Vine Mealybug Identification posters are available for $4.00 each from this office. You can also download and print your own smaller bilingual posters from this website:

http://ucce.ucdavis.edu/files/filelibrary/2020/8893.pdf

Syrah Disorder

By now most Syrah growers have either heard of or have had first hand experience with a phenomenon that has been coined "Syrah Disorder." Typical symptoms include affected vine leaves turning a reddish-brown color around veraison, with symptoms that might look like a blend of leaf roll virus, potassium deficiency, salt burn, and/or severe water stress. Fruit from affected vines ripens very poorly if at all, with very poor color and high potassium levels. This primarily appears to affect Syrah (including Shiraz and Syrah Noir) plantings at present. The disorder has become increasingly prevalent in recent years. Affected vines may not necessarily show symptoms in subsequent years, and other varieties at the same site do not show similar symptoms.

There are numerous theories to explain what is causing this to occur with Syrah; these include nutrient imbalances, poor planting stock, viruses, unknown pathogens, excessive cropping levels, and excessive water stress. I have been focusing my attention on the role of water stress, as some recent research on Syrah in Europe indicates that the variety's unusual response to drought could, in theory at least, make it more prone to the type of behavior that we have seen in the last few seasons. The recent spell of unusually dry winters, marginal quality irrigation water, increasing soil salinity, and minimum irrigation strategies will all increase the degree of water stress suffered by vines, and perhaps lead to an increasing incidence of the disorder. However, it should be emphasized that this is just one hypothesis explaining the phenomenon; other factors should not be dismissed without adequate research, and there may ultimately be multiple factors that together lead to the symptoms that we see.

Meeting Announcement: Syrah Disorder Task Force

The second meeting of the ‘Syrah Disorder Task Force’ will be held at the J. Lohr Wine Center on April 19, 2004. An overview of the current theories will be presented, along with an outline of the research planned for the 2004 season. There will be ample opportunity for grower participation in this research. All those interested are invited to attend.

When: April 19, 2004; 10:00 a.m. to 11:30 a.m.
Where: J. Lohr Wine Center; 6169 Airport Road, Paso Robles

Please RSVP by April 16 at (805) 781-5940

Atmometers for ET estimation

Having a locally accurate measurement of reference evapotranspiration (ETo) is a fundamental requirement to accurately employ a climate-based irrigation management strategy. Many growers, particularly in the more remote coastal areas, do not have local weather stations to provide this data. Atmometers, due to their very low cost and simple operation, are a possible alternative to more expensive weather stations for a grower whose primary interest is in measuring ETo.

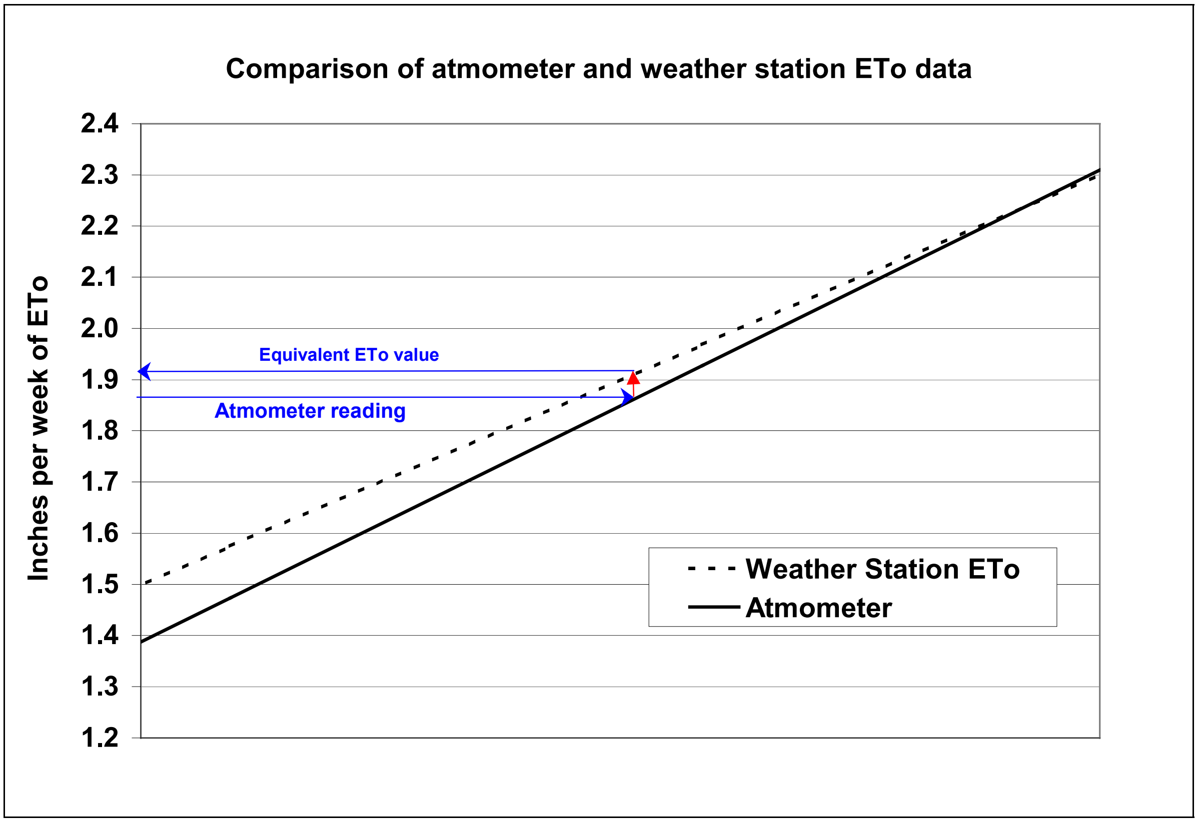
Atmometers rely on the direct evaporation of water to estimate reference evapotranspiration (ETo). In contrast, weather stations measure ETo based on an empirical formula with measurements of air temperature, humidity, solar radiation, and wind speed. I have been conducting research over the past two seasons comparing atmometer readings to weather station ETo data, to determine how the readings differ in the field. Based on these results, the atmometers tended to give lower values at the lower levels of evapotranspiration, with the differences decreasing as ET rates increased. During the peak summer irrigation period when ET rates were relatively high, little if any difference was seen between the atmometers and weather stations. This relationship is shown in the chart on the following page.

In practice, most users will probably find it convenient to read the atmometer once a week at a set time, for example every Monday at 8 am. The chart on the following page can be used to convert such weekly atmometer measurements into an equivalent weekly weather station ETo value. To use the chart, find the weekly atmometer reading on the y-axis, and trace a horizontal line to where it intersects the solid “Atmometer” line; then trace a vertical line to where it intersects the dashed “Weather Station” line, and finally trace a horizontal line back to the axis and read the equivalent ETo value. In the chart example below, a weekly reading of 1.86 inches on an atmometer is equivalent to about 1.92 inches of weather station ETo for the same time period. Alternatively, the following equation can be used, for **weekly data** measured in **inches** only:

Weather station ETo (inches) = (0.87 x Atmometer reading) + 0.30

For data measured in centimeters, the following equation can be used, but again only for weekly data:

Weather station ETo (cm) = (0.87 x Atmometer reading) + 0.76



Salinity management for drought years

The past several winters have been unusually dry for most locations on the Central Coast; this lack of winter rainfall has implications for water and salinity management throughout the rest of the season. The loss of productive irrigated farmland due to salinization is nothing new. One of the earliest irrigated civilizations developed in the Fertile Crescent, an arid lowland area between the Tigris and Euphrates Rivers in what is now Iraq. Due to poor soil drainage and high salt irrigation water, the farmland slowly became saline and production gradually declined, which ultimately led to a collapse of that civilization by about 2300 B.C. Luckily, our understanding of salinity management has improved dramatically over the last few millennia. However, without an understanding of the processes involved and how to manage them, our crops today are just as susceptible as they were thousands of years ago.

Of significant concern in many parts of the Central Coast is the accumulation of salts in the root zone due to insufficient leaching by winter rainfall. Unlike many other parts of California, this area is dependent nearly entirely on groundwater for irrigation, and much of this water has significant salt levels. Crop transpiration and evaporation both remove pure water from the soil, leaving the salts behind to accumulate in the soil slowly over time. As this salt load increases, it leads to problems with plant growth due to osmotic effects, changes in soil chemistry & structure, and specific toxicities. The nature of the groundwater and soil will determine which of these effects are of the most concern for each location.

The groundwater chemistry of a particular region is determined primarily by the minerals of the overlying strata, through which water percolates downward until it reaches the groundwater. The primary ions in groundwater include sodium (Na^+), magnesium (Mg^{2+}), calcium (Ca^{2+}), potassium (K^+), bicarbonate (HCO_3^-), sulfate (SO_4^{2-}), and chloride (Cl^-). Waters are usually described by their dominant cations (positively charged ion) and dominant anion (negatively charged ion); for example, a sodium-bicarbonate water has sodium as the dominant cation and bicarbonate as the dominant anion. Common water chemistries in this region include calcium-bicarbonate, sodium-bicarbonate, magnesium-bicarbonate, and sodium-chloride.

As the total salt level in the root zone increases, it becomes more difficult for roots to extract water from the soil; this is the osmotic or 'drying' effect of salts on plants. This salt level is measured with the EC_e, the electrical conductivity of the soil saturation extract (units of dS/m or the older mmho/cm, both the same numerically). As the EC_e value increases, the 'drying effect' increases and growth is reduced; Table 1 below shows the general criteria for grapes.

Table 1	
EC_e (average for rootzone, dS/m)	**Effect on grapevine**
Below 2.5	Grapevines usually not appreciably affected (0% to 10% yield reduction)
2.5 – 4.1	May restrict grapevine growth to appreciable extent (10% to 25% yield reduction)
4.1 – 6.7	Severely restricts grapevine growth; varying degrees of leaf burn are expected (25% to 50% yield reduction)
6.7 and above	Severe effects; including extensive leaf burn and possible vine death
Source: UC ANR Publication 4087 "Grapevine nutrition and fertilization" (Out of print)	

Sodium, in addition to increasing vine water stress through osmotic effects, also degrades soil structure by 'dispersing' clay particles, or breaking down the clay aggregates into individual clay particles. These dispersed clay particles form dense, impermeable crusts in the surface soil layers, leading to poor aeration, infiltration and drainage. These effects are often seen late in the summer on sloping vineyards; rather than infiltrating downwards, the irrigation water moves across the soil surface only to infiltrate somewhere in the row middle, leaving the vine roots dry.

Laboratory analysis of soils can determine the ESP (Exchangeable Sodium Percentage), which is the proportion of sodium relative to the total cations held on the soil's exchange sites. As the ESP value increases, so do problems related to sodium. Table 2 shows general guidelines for the ESP effects on soil permeability.

Table 2	
ESP (%)	**Effects on soil permeability**
Below 10	Generally no permeability problem
10 – 15	Possible permeability problems on clay loam and clay soils
Above 15	Permeability problems are likely on all mineral soils with the possible exception of sands and loamy sands
Source: UC ANR Publication 4087 "Grapevine nutrition and fertilization" (Out of print)	

Likewise, laboratory analysis of water samples can determine the SAR (Sodium Adsorption Ratio), which is related to the ratio of sodium to both calcium and magnesium in the water. As with the ESP, the higher the SAR, the greater the likelihood of sodium-related permeability problems; Table 3 shows the general relationship.

Table 3	
SAR	**Potential effects for soil permeability problems**
Below 6.0	Low potential
6.0 – 9.0	Increasing potential
Above 9.0	Severe potential
Source: "Irrigation Water Analysis Guidelines" UCCE information sheet	

The bicarbonate (HCO_3^-) ion can lead to significant changes in the soil chemistry as well as increasing the total salt content. Continual additions of bicarbonate over time will gradually raise the pH of the soil, leading to increasing problems with the availability of nutrients such as iron, zinc and phosphorous. Soils high in Ca, Mg, or K-bicarbonate salts are commonly called 'white alkali'. As the soil pH increases, bicarbonates are converted to carbonates, which then combine with the calcium and magnesium and precipitate as insoluble carbonate solids. These solids effectively reduce the active content of calcium and magnesium in the soil, thereby increasing the relative proportion of active sodium. Thus the combination of sodium and bicarbonate in irrigation water can be particularly troublesome; the combined effects of these components can create 'black alkali' soils, with very high pH, highly dispersed clays, and very poor permeability.

Specific salt toxicities are primarily a concern with boron, chloride, and to a lesser extent sodium. Boron (B) is unusual in that area vineyards experience both toxicities and deficiencies of this element. In areas with significant boron in the irrigation water, it can accumulate in the root zone in the absence of adequate leaching. Table 4 shows the relationship between general soil boron levels and their effect on grapevine growth.

Table 4	
Soil B (ppm, measured in saturation extract)	**Grapevine symptoms and effects**
0 - 0.5	None
0.7 – 1.0	Possible, very slight
1.0 – 1.5	Slight
1.5 – 2.5	Moderate
2.5 – 4.0	Severe
Above 4.0	Very severe
Source: UC ANR Publication 4087 "Grapevine nutrition and fertilization" (Out of print)	

Chloride and sodium toxicities are generally associated with the total soil salinity, causing the typical marginal leaf burn symptoms at higher salinity levels. Tissue analysis is the most effective diagnostic tool for troubleshooting these toxicities, but varieties and rootstocks differ widely in their tolerances; some general guidelines are shown in Table 5 on the following page.

Winegrapes may be more vulnerable to the effects of salinization due to our desire for high quality crops. Winegrape irrigation regimes typically utilize deficit irrigation to some degree, meaning that the applied amount of irrigation is less than what the vines could potentially use. Thus little, if any, applied irrigation water generally leaches below the root zone. If winter rainfall is abundant and the soil is well drained, the season's salts should be leached out of the root zone and few salinity problems would be seen. However, in the absence of adequate natural leaching, the only alternative for removing salts is to irrigate with an additional quantity of water to move the accumulated salts below the root zone. This additional quantity is referred to as the ‘leaching fraction’. Drip irrigation systems are typically not as effective in leaching salts downward as compared to either rainfall or sprinkler irrigation; many of the salts tend to move laterally and are then wicked upward and left behind on the soil surface as water evaporates. These two factors, an insufficient leaching fraction during the irrigation season and an inefficient downward movement of salts, mean that drip-irrigated winegrapes will likely retain a relatively large portion of the applied salts near the root zone in the absence of adequate winter rainfall.

Table 5	
Total chloride	**Effects**
Over 0.5% in petioles at bloomtime	Possibly toxic
1.0% – 1.5% and above in petioles, midsummer to late summer	Toxic
Over 0.5% in blades	Toxic
Total sodium	**Effects**
Over 0.5% in petioles	Possible problems
Over 0.25% in blades	
Source: UC ANR Publication 4087 “Grapevine nutrition and fertilization” (Out of print)	

Remediation of a salt-affected soil consists of two fundamental steps:

1) Leaching the accumulated salts below the root zone;
2) Displacing sodium from the soil’s cation exchange sites with calcium.

Sufficient winter rainfall is the easiest and most effective way to leach the salts from the root zone, but as recent years attest it is not always a reliable method. Sprinkler frost protection, where practiced, is often applied in sufficient amounts to leach the root zone as well. However, if soil drainage is poor, and particularly if poor quality frost protection water is used, this may simply aggravate the situation. Off-season drip irrigation can help by priming the soil to make any rainfall more effective in leaching.

Displacing the sodium with calcium is achieved by adding gypsum (calcium sulfate) to the soil, generally applied on the soil surface beneath the emitters. As irrigation or rainwater passes through the gypsum, some calcium dissolves into the water and in turn displaces sodium from the soil’s cation exchange sites. For soils with an adequate content of ‘Free Lime’ (as determined by a soil analysis), sulfur can be applied instead of gypsum; the sulfur dissolves the lime in the soil, freeing up calcium to then displace the sodium. In areas with significant sodium content in the irrigation water, gypsum applications will have to be applied regularly in order to maintain desirable soil chemical and physical properties.

Other related resources:

Rhonda Smith, Sonoma County Farm Advisor, has compiled a large listing of commercial agricultural labs in the state; this list can be viewed online at:

http://cesonoma.ucdavis.edu/VITIC/lab_report/lablist.htm

UCCE Publication 8066, “Irrigation Water Salinity and Crop Production”, can be downloaded for free at:

http://anrcatalog.ucdavis.edu/pdf/8066.pdf

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