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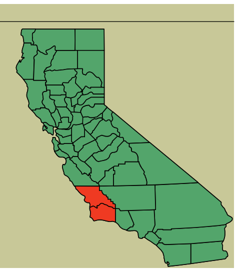
University of California Cooperative Extension

Grape Notes

San Luis Obispo & Santa Barbara Counties



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Paso Robles Soil Salinity Survey, Part II

In the fall of 2006 I sampled 100 vineyards east of Paso Robles to assess the overall soil salinity conditions in the area. After the extremely dry 2006/2007 winter, I again sampled the same soil locations, to determine how much soil salinity had changed with one very dry winter. Levels of all salinity parameters increased significantly.

The soil salinity survey which I conducted in 2006 was intended to assess the overall soil salinity conditions in mature vineyards in the region east of Paso Robles. The impetus behind this survey was that some vineyards in the area were experiencing unsatisfactory vine growth, and that high levels of soil salinity were coincident with the poor vine growth at a number of locations. The results of this first year survey were presented in the April 2007 Grape Notes newsletter; for background on the study and the parameters measured, please refer to the first article.

The initial plan was to repeat the soil sampling at the same 100 locations at 3-5 year intervals, to assess any gradual long-term changes in soil salinity over time, as generally we consider such changes in soil chemistry to happen rather slowly. However, the extremely dry winter of 2006/2007, which was the second driest on record since 1952 at Paso Robles, presented an opportunity to evaluate the degree of soil salinity change in a single season under conditions of minimal rainfall leaching. Therefore, in September of 2007 I sampled the same 100 locations as in 2006, following the same protocol. Briefly, all samples consisted of multiple one-foot deep cores, taken at random locations within the vine row, encompassing both wetted and non-wetted areas; samples were then analyzed for the complete 'Salinity Panel' by the DANR Lab at UC Davis. The summary results of both the 2006 and 2007 samplings are shown in Table 1 below.

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Table 1. Summary salinity values for 2006 and 2007.

Note: double asterisks (**) next to the % change values indicate a highly significant difference between years, a single asterisk (*) indicates a significant difference, and no asterisks indicate that no significant difference was observed.

Parameter (units)	2006 mean values	2007 mean values	% change in mean values, 2006 to 2007
EC_e (dS/m)	2.23	2.51	13%**
SAR_e	3.52	4.21	20%**
SP (%)	39.49	38.17	-3%**
pH	7.34	7.30	-1%
Na^+ (meq/L)	9.07	11.05	22%**
Cl^- (meq/L)	3.34	4.40	32%**
Ca^{++} (meq/L)	13.1	14.1	8%
Mg^{++} (meq/L)	4.23	4.74	12%
K^+ (meq/L)	16.39	25.73	57%
HCO_3^- (meq/L)	3.10	2.82	-9%*
CO_3^{--} (meq/L)	<0.01	<0.01	NA

The electrical conductivity (EC_e), sodium adsorption ratio (SAR_e), sodium (Na), and chloride (Cl) levels all showed highly significant increases from 2006 to 2007. The saturation percentage (SP), a measure of how much water is contained in a soil sample that is at saturation, showed a highly significant decrease from 2006 to 2007. This is most likely due to measurement error, as generally we consider the SP value to be an intrinsic, unchanging property of the soil (primarily a function of the particle sizes); it would not be expected to change over such a short time. The SP measurement method is also relatively subjective, with readings reproducible within +/- 8-12%.

The EC_e, which is related to the total salt content in the soil, is the parameter that will have the most significant impact on vine growth at the levels seen in the area survey; both the sodium and the chloride levels are probably too low at the vast majority of sites for specific ion toxicity to be a concern. In general, when EC_e levels increase above the threshold level of 2.5 dS/m, vine growth and yield will decrease linearly; Figure 1 below shows this general relationship between soil EC_e and growth. Figures 2 and 3 show the EC_e values for 2006 and 2007 respectively plotted onto this general relationship. In 2006, 35% of the sites sampled had EC_e values which exceeded the 2.5 dS/m threshold; in 2007, 43% of the sites did.

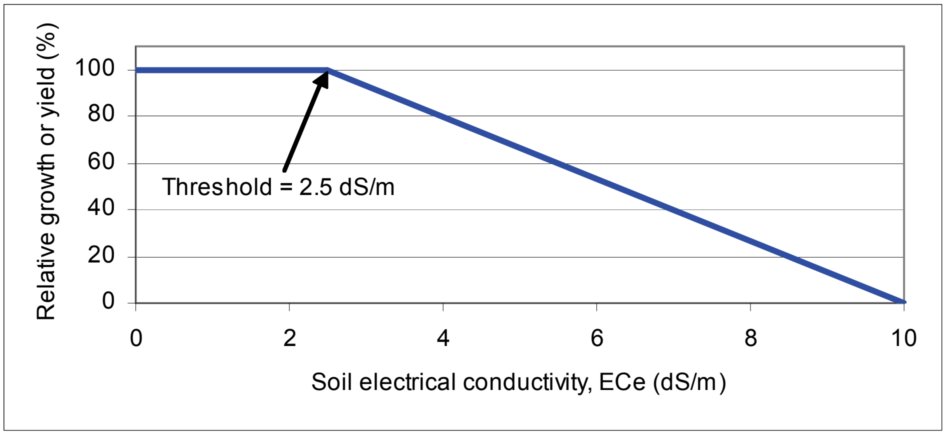

Figure 1. The general relationship between the soil electrical conductivity and relative vine yield. This relationship is representative of a moderately sensitive rootstock. The threshold value will be higher for rootstocks having more tolerance of salinity, and lower for rootstocks having more sensitivity to salinity.

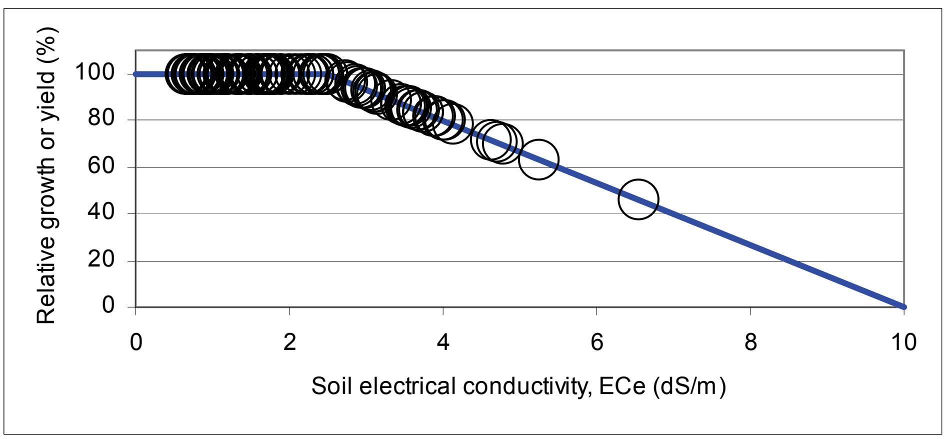

Figure 2. The 2006 year EC_e values, superimposed over the general relationship curve. Each circle represents the EC_e reading from one location; all 100 locations are plotted on this chart. In 2006, 35% of the sites had EC_e values that exceeded the threshold value of 2.5 dS/m.

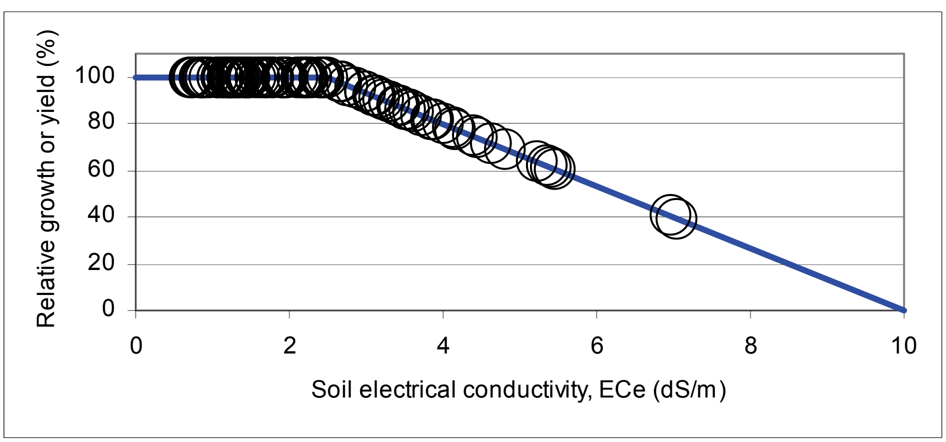

Figure 3. The 2007 year EC_e values, superimposed over the general relationship curve; in 2007, 43% of the sites had EC_e values above the threshold.

Recent research in Australia, where salinity conditions significantly more severe than those measured in this work have been observed, has helped classify different rootstocks for their response to salinity. The most sensitive rootstocks have a threshold EC_e value of 1.8 dS/m; these include 3309, 1202c, and most own-rooted *Vinifera.* Moderately sensitive rootstocks have a threshold EC_e value of 2.5 dS/m; these include the rootstocks 5c, 5bb, 110R, and 99R. Moderately tolerant rootstocks have a threshold EC_e value of 3.3 dS/m; these include the rootstocks St. George, 140Ru, Schwarzmann, 101-14, and Ramsey. Tolerant rootstocks have a threshold EC_e value of 5.6 dS/m; this includes the rootstock 1103P (from Skewes et al., 2007, citations therein). Therefore, it is important that a grower be aware not only of the soil salinity levels in the vineyard soil, but also of the relative sensitivity of their particular rootstocks to different salinity levels.

The additional stress due to elevated salinity may not produce any obvious symptoms other than reduced vegetative growth and crop yield, making the diagnosis of the problem difficult without soil analysis data. In the absence of site-specific soil salinity information, it would be easy to attribute this reduced performance to other causes such as reduced soil fertility. Changes in soil chemistry and vine response are also very gradual; even the exceptionally dry winter of 2006/2007 only increased the average soil EC_e by 0.28 dS/m, which for a sensitive rootstock would result in a decrease in growth or yield of about 4%. While this may seem like a small reduction, remember that without adequate leaching salts will accumulate within the rootzone year after year, leading to larger cumulative effects. If yields were to decrease by 4% per year every year, this would eventually become very noticeable.

An important thing to keep in mind when making measurements of soil salinity is that salinity levels are highly variable within the soil. With the source of salts generally being the irrigation water, we expect to find higher salt levels at the fringes of the soil wetting front that extend outwards from where the drip irrigation is delivered to the soil. The highest levels are often found on the soil surface, where moisture evaporates and leaves behind the salts. If drainage is impeded on the site, high levels may also be found at deeper depths where water is accumulating. Thus, the one-foot deep samples which I took for this survey are not necessarily representative of the salinity conditions of the entire root zone of the tested vineyards. Unfortunately, taking deeper samples, or additional samples from outside the vine row, was not feasible for this survey. However, for making management decisions it may be useful to assess the deeper soil depths, particularly at sites with poor drainage. The question of just where the salts are ending up in our soils has not been looked at in this area; future work should address this question.

The take-home message is that growers on the Central Coast need to be aware of the effects that elevated salinity levels can have on reducing vine growth and yield. It will be prudent for many growers in this area to make soil salinity testing a routine part of their vineyard management, particularly those in locations where irrigation water is known to be of marginal quality, soil drainage is poor, additional leaching water is not applied, and the rootstocks employed are relatively sensitive to salinity.

References and further reading:

Skewes, M., Adams, T., and R. Stevens. 2007. Salinity impacts of low Murray River flows in the South Australian Riverland. Government of South Australia, Fact sheet number 05/07. Website: http://www.pir.sa.gov.au/pirsa/more/factsheets

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http://ucanr.org/grapenotes

Announcements:

Vine Mealybug Tailgate Meeting in the Santa Ynez Valley

The Santa Ynez Valley seemed to have avoided the vine mealybug over the past several years, but infestations found last season indicate that the pest has finally arrived. This tailgate meeting will discuss the history, identification, biology, detection, and treatment of the vine mealybug.

Date: July 15, 2008

Time: 10:00 am - noon

Location: Melville Vineyards & Winery; 5185 East Hwy 246, Lompoc

Cost: No charge

For additional meeting details and to register online, please see the following website:

http://ucanr.org/tailgate

Refreshments will be provided, and DPR CE credits have been applied for.

Special issue of *Agricultural and Resource Economics Update*

The latest update from the UC Department of Agricultural Economics focuses entirely on the California winegrape industry; you can view this online at:

http://www.agecon.ucdavis.edu/extension/update/issues/v11n4.pdf