Paso Robles Soil Salinity Survey

Mark Battany
UC Cooperative Extension, San Luis Obispo, California, U.S.A 93401

A number of vineyards in the region east of Paso Robles have in recent seasons reported measured soil salinity levels or vine symptoms that suggest that significant accumulation of salts have been occurring in area soils.

The environmental conditions of this particular area make the vineyards prone to salt accumulation; these conditions include irrigation with groundwater of variable salt content, the use of drip irrigation with limited leaching capabilities, the application of deficit irrigation regimes which do not include additional leaching fractions, and limited winter rainfall to flush salts from the rootzone. Some area soils also have poor drainage characteristics, preventing the adequate leaching of salts even if sufficient water is available to do so. Over time, the above conditions can be expected to result in gradually increasing soil salinity levels, in particular if there are no occasional heavy rainfall seasons that leach the accumulated salts.

This survey project was initiated in 2006 to evaluate the current soil salinity levels in the area east of Paso Robles, with the intention that the sampling be repeated every three years at the same locations to assess any long term changes in salinity conditions.

Soil samples were taken at 100 mature vineyards within the region roughly encompassed by the cities of Paso Robles, San Miguel, Shandon and Creston. At each location, composite samples were made from 15 surface cores, with each core encompassing the surface 30 cm (12 inches) of the soil; all samples were taken from within the vine row. Any obvious non-dissolved residues of recent amendment applications (e.g. gypsum) on the soil surface were scraped away before taking the core samples, but otherwise no attempt was made to exclude amendments from the samples, as the goal was to document the soil conditions that the vines actually experience in the field. Sampling occurred in September and October 2006, prior to any significant fall rainfall. All samples were tested by the UC DANR Lab for the Saturation Percentage (SP), pH, Electrical Conductivity (ECe), Calcium, Magnesium, Potassium, Sodium, Chloride, Bicarbonates and Carbonates; the Sodium Adsorption Ratio (SARe) was also calculated. GPS coordinates were recorded at each sampling location to permit follow-up sampling at the same locations in future years. The summary values of all parameters for the 100 sites are shown in Table 1.

A primary parameter of interest in this study is the soil electrical conductivity (ECe), because of its deleterious effects on overall vine growth and productivity. The average ECe value of all samples was 2.2 dS/m, approaching the standard threshold value of 2.5 dS/m, above which effects on growth and yield reduction are more likely to occur (Christensen et al. 1978). Twenty-nine percent of the locations had soil ECe values between 2.5 and 4.1 dS/m, where growth can be appreciably reduced, with a yield reduction of 10-25%. Six percent of the locations had soil ECe values over 4.1 dS/m, where significant growth restrictions and leaf burn can be expected, together with yield reductions of 25-50%. The fact that these values were measured fairly soon after the very wet winter of 2004/2005 suggests that during extended dry weather cycles, such as the period of several years prior to the 2004/2005 winter season, that many area soils could have significantly higher soil ECe levels than were found during this survey. The improved growth noted in many area vineyards in 2005 and 2006 as compared to the preceding seasons can likely be attributed in part to the lower soil salinity levels due to the leaching effects of the high winter rainfall.

The average SARe value of the 100 locations was 3.5. Fifteen percent of the sites had SARe values above the standard threshold value of 6.0, above which sodium-related soil physical problems will generally tend to become evident.

Only two of the 100 samples had sodium values that exceeded the 30 meq/L threshold, above which sodium toxicity is generally considered to become problematic. Likewise, only two of the samples had chloride levels above the 10 meq/L threshold (Peacock and Christensen 1978).

The average pH of the 100 locations was 7.34, but with a wide range. Prior to being cultivated, many of the soils in this area had surface horizons with neutral to slightly acidic pH. Cultivation practices that mixed the surface layers with deeper, more alkaline layers, and the use of alkaline irrigation water, have over time raised the pH of the surface layer.

This research project has conducted the first comprehensive evaluation of soil salinity in the vineyard areas east of Paso Robles. It has identified that soil salinity conditions are at levels which can be expected to cause appreciable, and at some locations significant, reductions in growth and yield in numerous area vineyards. The salinity levels documented in this project represent the condition of the soils following significant leaching after a recent heavy rainfall season, suggesting that under prolonged drier conditions the salinity levels may be appreciably higher. Repeated sampling at the same locations at three-year intervals will indicate to what degree, if any, salinity conditions are changing over time in area vineyards.

References

Christensen, L.P., Kasimatis, A.N., and F.L. Jensen. 1978. Grapevine nutrition and fertilization in the San Joaquin Valley. University of California ANR Publication 4087.

Peacock, W.L. and Christensen, L.P. 2000. Interpretation of soil and water analysis. In: Christensen, L.P., editor. Raisin Production Manual. University of California ANR Publication 3393. p. 115-120.

Table 1. Summary soil test results for the 100 locations

Component	Average	St. Dev.		Component	Average	St. Dev.
EC (dS/m)	2.2	1.2		HCO3 (meq/L)	3.1	1.1
pH	7.3	0.6		Ca (meq/L)	13.1	10.0
SARe	3.5	2.1		Mg (meq/L)	4.2	3.8
Na (meq/L)	9.1	6.5		K (meq/L)	16.4	16.1
Cl (meq/L)	3.3	3.3		SP (%)	39.5	10.2