Sodium, Chloride and Boron Accumulation in Almonds – Westside Survey

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Problem and its Significance:

Almond growers have been pushing the limits on almond salt tolerance for the last 10 years as land price and availability have skyrocketed while available surface water supplies have decreased and groundwater salinity is increasing. Many of these plantings look good for several years and then hit the wall as one or more specific toxic ions (especially boron) finally reaches the critical level in the tree that can limit water/nutrient uptake, cause severe gumming, leaf burn, reduced growth and eventually death. There is no data documenting woody tissue deposition / concentration of these ions as a function of soil salinity to determine if this strategy of tissue analysis would give a grower an early warning sign of significant pending toxicity problems not yet seen in leaf tissues.

Objectives/procedures:

1. Using a 3rd leaf planting (Hansen rootstock, Nonpareil and Monterey scions) select 4 areas that range from 0.5 to 5 dS/m EC and ppm soluble boron.
2. Document differences in tree stature corresponding to these areas.
3. Correlate soil salinity and specific ion concentration with rootstock, scion and traditional leaf tissue samples to see if wood sampling provides an early indication of pending toxicity problems.

Project Title: **Mitigation of Salinity and Water Penetration Problems in Westside Almonds**

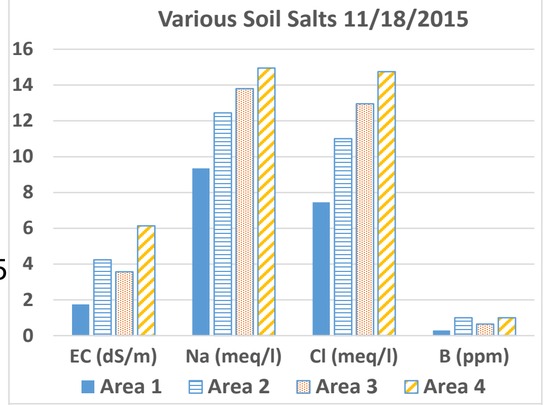
Problem and its Significance: Excess sodium and the extremely fine particle size of many of these soils results in poor aggregation, soil structure and, therefore, water movement. Efficient water penetration and leaching is critical to enable profitable production in these orchards.

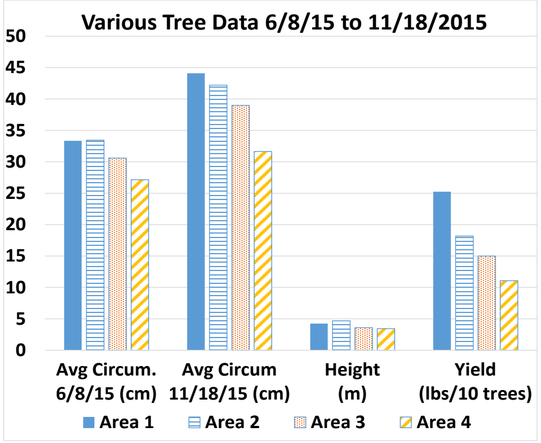
Treatments (added to grower use of gypsum and acid):

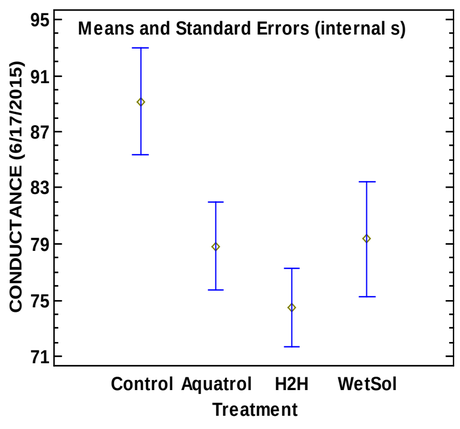
1) Control – no additional surfactant
2) Aquatrols Water Max (non-ionic surfactant + long-chain alkyl/polyol aggregation aid): 1st application 5/21 @ 1 g/ac, 2nd @ 0.5 g/ac, 3rd @ 0.5 g/ac, 4th @ 0.5 g/ac
3) H-2-H Soluble Organics (digested food waste yielding complex amino acids, micronutrients, etc.): 1st application 5/27 @ 20 g/ac, 2nd @ 10 g/ac, 3rd @ 10 g/ac, 4th @ 10 g/ac
4) WetSol (non-ionic surfactant): 1st application 5/21 @ 1 g/ac, 2nd @ 0.5 g/ac, 3rd @ 0.5 g/ac, 4th @ 0.5 g/ac

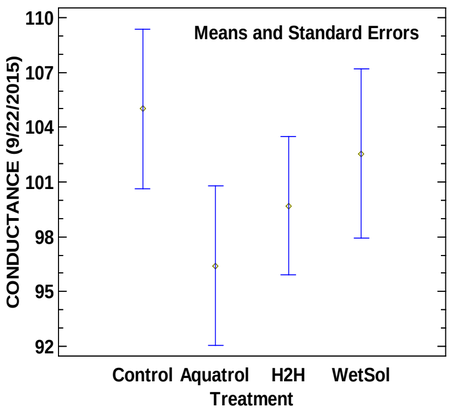
Subsequent application windows depending on irrigation schedule: 2nd 6/8-12, 3rd 6/22-26, and 4th 7/6-10

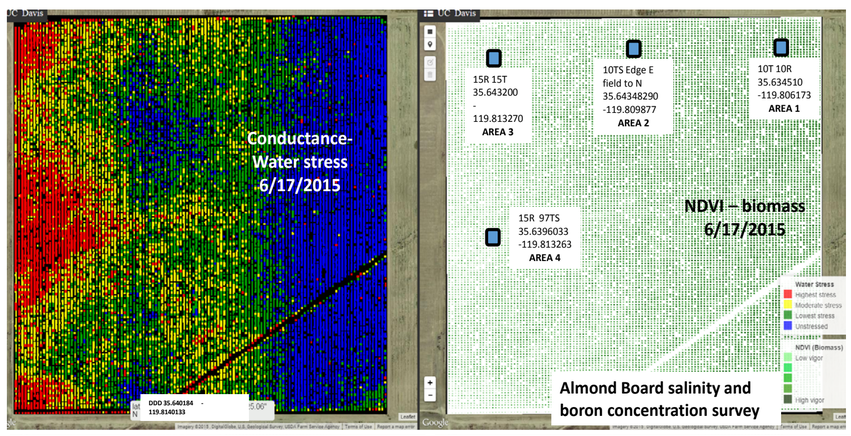
Area 4 – smaller trees
Soil ECe 6.1 dS/m, B 1.0 ppm, a few trees with bad gummosis

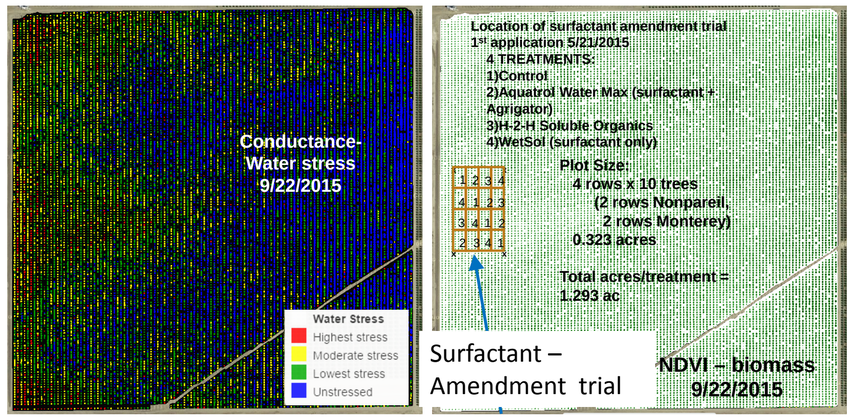












Results and Discussion:

A 3rd leaf quarter section almond block in NW Kern County – 50/50 Nonpareil and Monterey were planted on Hanson rootstock in 2013. A significant gradient in increasing native salt load in this soil is obvious as you move from East to West despite having leached this ground with two foot of water using sprinklers prior to planting. The total soil salt load (EC), sodium (Na), chloride (Cl) and boron (B) increases 2 to 3-fold from Area 1 to 4. The interesting result so far is that all tissue samples for leaves, trunk corings and hull boron content at harvest show no real difference with respect to Na, Cl and B. The trunk circumference of Area 4 is 19% less than Area 1, as would be expected with the higher salinity stress. The 3rd leaf yield was very disappointing for this block – being 312 lb/ac at best for Area 1 and 137 lb/ac for Area 4, a 56% decrease.

At this time there is no measurable increase in rootstock or scion wood tissue Na, Cl or B correlated with higher soil concentrations from Areas 1 to 4. There does appear to be a higher amount of gummosis on the occasional tree in Areas 3 and 4 compare to Area1. The elevated salt load and associated osmotic resistance to water uptake has definitely decreased tree size in Area 4, but the usual marginal salt burn associated with this is basically absent. Surfactant amendments made no difference in tree water stress (CONDUCTANCE) or growth/vigor (NDVI).

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