Understanding the variability in salt uptake and accumulation among different almond cultivars- Year 1

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Introduction:

The counties of Fresno and Madera account for more than 30% of all bearing acreage under almonds in California (Crop Reports, 2013). The area under almonds has been increasing for the past several years. Along with that trend, we have seen many newer orchards being planted in marginal soils with issues like soil and groundwater salinity among others. Reports about salinity effects in almonds have been coming lately from the central valley region in general and from the western parts of valley in particular. Interestingly, some variability has been observed among different cultivars with regards to being affected by sodium and chloride toxicity.

Objective:

The objective of this sampling study in the first year was to understand the variability in salt uptake among different almond cultivars and the accumulation of sodium and chloride within different tree parts.

Methods/sampling procedures:

- Three sites were selected in Fresno county , for tissue sampling. These were located near Sanger, Kerman & Cantua Creek.
- Soil types were Delhi loamy sand (Sanger), Hanford sandy loam (Kerman) & Ciervo Clay (Cantua Creek).
- Latest soil & water test reports were taken from growers' records.
- Three cultivars- Non Pareil, Aldrich and Monterey were selected.
- All trees were on Nemaguard rootstock.
- Number of replicate trees in each cultivar was 3.
- At least 30 leaves were sampled randomly from each tree canopy for leaf tissue analysis.
- Trunk & rootstock tissues were sampled by drilling 1" deep holes. Outer bark shreds were discarded.
- Sufficient volumes of tissue were collected by drilling several holes on the side of the tree trunks.

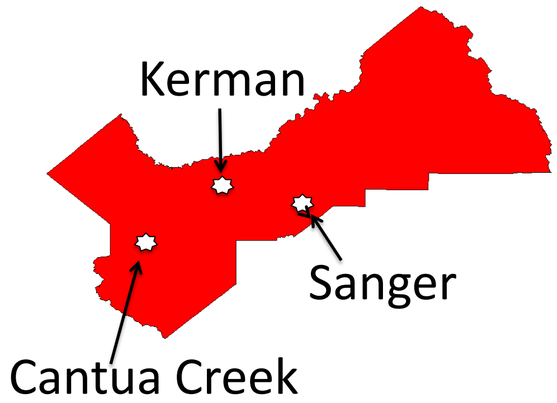

Figure 1. Location of the orchards used for this sampling study within Fresno county

Figure 2. Aldrich row at Sanger location.

Results & discussion

It was observed in all three locations that leaf sodium concentration in Aldrich and Monterey trees was significantly higher than Non-Pareil (Figure 3). In terms of total sodium concentration, Kerman location was worst among all three sites. The site conditions in Kerman were: Hanford Sandy Loam, with silt substratum, a soil pH of about 7.5 and an EC less than 1.4. In this site soil samples taken from two areas (one with healthy looking and other with badly affected trees) were also analyzed. The saturation percentage of the soil was in the lower 20's indicating sandy soil. The irrigation water at this site has high pH (8.1) and contains high levels of Sodium and Chloride ions (2.7 and 1.1 meq/L, respectively).

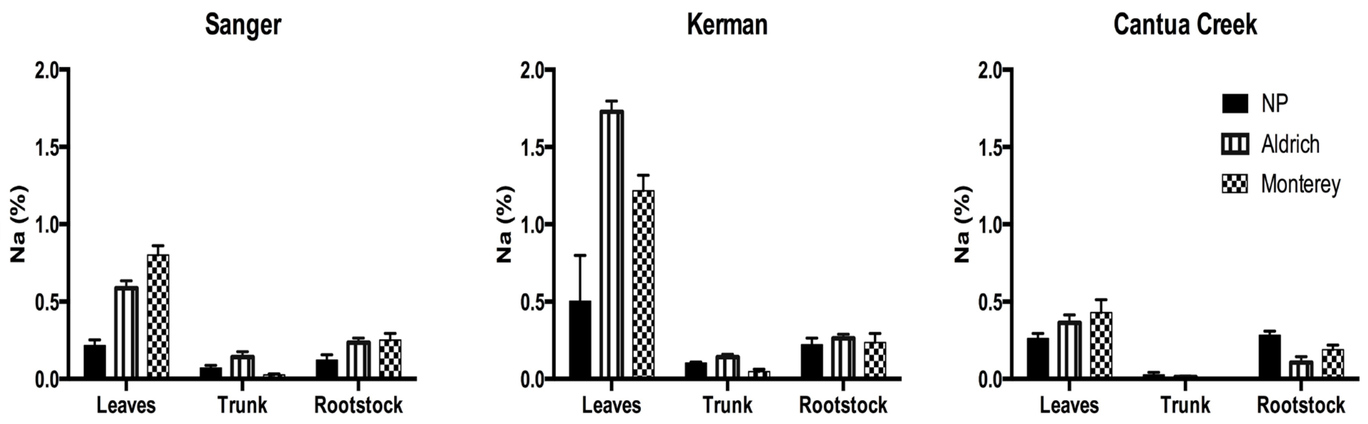

Figure 3: Concentration of sodium in different tree parts in three almond cultivars. n=3

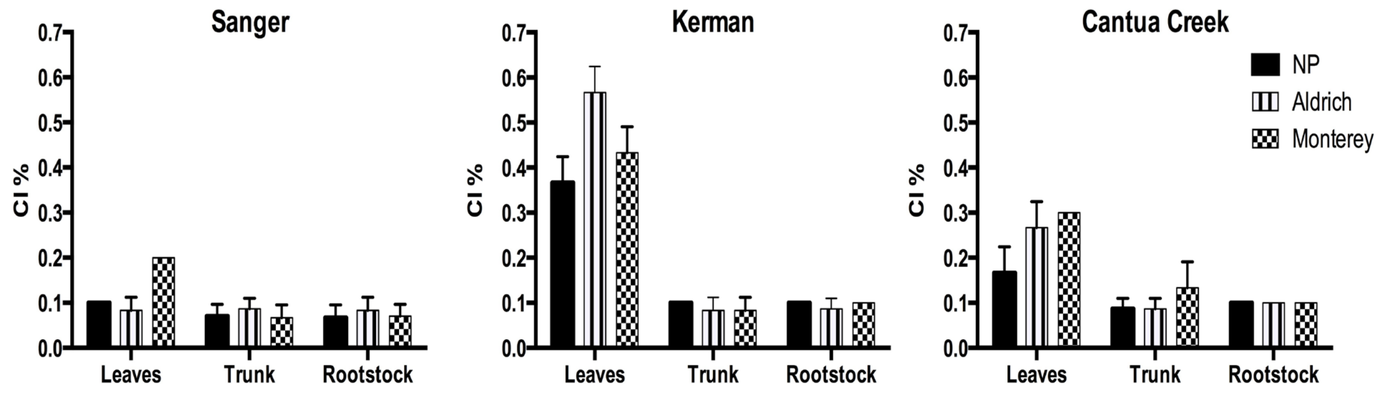

Figure 4: Concentration of chloride in different tree parts in three almond cultivars. n=3

The rootstock samples were generally similar in terms of sodium concentration, except Cantua Creek site. At this site, rootstock tissue in case of Non-Pareil trees showed significantly higher accumulation of sodium below the graft union. This generates further interest as to how different scions vary regarding accumulation of salts below the graft union.

Leaf chloride concentrations were significantly higher in Monterey trees at Sanger site while in Kerman orchard, Aldrich had significantly higher leaf Chloride levels as compared to Non-Pareil and Monterey (Figure 4). Rootstock chloride levels were generally similar among all cultivars at all sites, with no significant differences.

Similar observations regarding varietal differences among different cultivars were also reported during 2014 by various UC Cooperative Extension Farm Advisors across the state.

The effect of salinity on the growth of almond trees is an important topic to be researched. However, there are many factors that could influence the uptake and accumulation of salts within the orchards, other than the rootstocks and scions, for example, cation exchange capacity of the soil, interaction with other cations present in the rootzone, pattern of exposure of the trees to salt conditions (continous application of saline water & soil over a long period of time versus occasional irrigation with high salinity water). With these factors in mind, this study will be continued in the coming years with specific emphasis on studying the underlying causes & effects of salt stress and on developing strategies for amelioration of such stresses.