Evaluation of Hydrosmart Electronic Water Conditioning (EWC) on Non-Bearing Seedless Lemon Trees in Coarse Sandy Soil

Aim

The objective of this field trial was to compare the response of non-bearing seedless lemon trees to Hydrosmart treated (HS) and untreated (HSU), EC 1.1 dS/m (630 TDS) irrigation water, which approximates the TDS of Colorado River water.

Results

An increase in growth of the non-bearing lemon trees was obtained by Hydrosmart treatment of EC 1.1 dS/m irrigation water, relative to those in the untreated EC1.1 dS/m group (Figure 1).

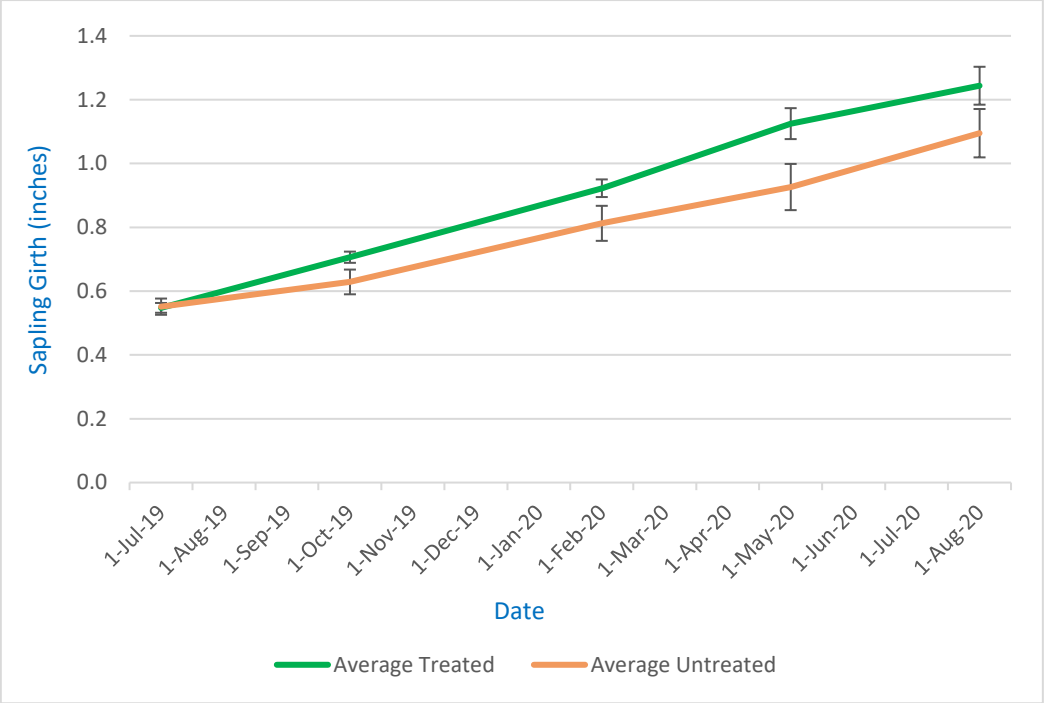

Fig. 1: Growth of lemon saplings in treated (green line) versus untreated (orange line) water of TDS 600 ppm, in dry Southern California over a 13 month period. Bars represent standard errors, calculated from 8 data points or plants per coordinate.

Discussion

A 20% increase in trunk growth of Hydrosmart treated versus untreated trees receiving EC 1.1 irrigation water was observed (Figure 1). Put in a different way, the treated plants are 4 months ahead of the untreated plants regarding growth, in a 13 month total time frame from planting. Increased nutrient uptake is the most likely reason for the increased growth. No detrimental effects were observed from irrigating the trees with either treated or untreated brackish water. Nutrient levels present in soil and leaves in this trial are the subject of further ongoing analyses. In summary, the trial shows potential for lemon trees in this irrigation regime to be watered 20% less than they currently are, for the same growth outcomes (saving much water), or else growth time can be reduced by one third for the same effect.

Methods

Sixteen, 1-year old, seedless lemon trees on macrophylla rootstock were planted in Carsitas coarse sand suitable for growing citrus, grapes and mangoes. The plot is located ½ mile north of the Salton Sea in North Shore, California. The trees were planted mid-December, 2018 on a square 6 ft x 6 ft spacing with two rows of eight trees each. The planting mix consisted of 50% native soil, 50% compost, and one-half tablespoon of Agropell 15-15-15 with 10% sulfur and one-half cup of Maxi-Plex Multipurpose Micronutrient 5-0-0 granular fertilizers.

A drip irrigation system was installed consisting of a 500 gal fiberglass holding tank with a 12 volt, 1.2 gpm diaphragm pump mounted in the tank and plumbed to a dedicated Hydrosmart unit (Digital 25 mm EO) to supply treated water, and a separate bypass line that supplied untreated water. This configuration supplied a total of two ¾ inch drip irrigation lateral lines from each of the treated and untreated tank systems. The treated and untreated trees were randomized within the plot. Each tree was serviced by two, 3 ft long, ¼ inch drip hoses that were run from the appropriate lateral line and terminated in a 4 gph, turbulent flow, drip emitter mounted on a stake approximately 6 inches above the ground.

Irrigation operation was controlled by a four station irrigation timer wired to a 24 VAC coil, double pole, single throw, definite purpose contactor. Initiation of the relay by the irrigation timer provided 120 VAC power to a 12 VDC 30 amp inverter in order to run the water supply pumps and power the Hydrosmart EWCs.

Two water sources were blended to achieve the desired electroconductivity (EC) of the experimental water for the trial: 1) domestic water supplied by the Coachella Valley Water District, Coachella, CA, which is a low salinity water with EC values consistently in the 0.27 - 0.28 dS/m (140 - 170 TDS) range; and 2) an onsite well that provided the salinity component. The water analysis performed during the development of the well gave 11,000 ppm TDS, which corresponds to an EC value of approximately 18.0 dS/m [Appendix E-1].

An exact analyses of the blended water source was conducted: Electrical Conductivity 1.14 dS/m (~630 ppm total dissolved solids), pH 7.6, Sodium adsorption ratio 8.4; Na 8.0 meq/L, Ca 1.8 meq/L, Mg 0.25 meq/L, Cl 4.7 meq/L, sulfate (SO_4) 59 ppm, B 0.08 ppm, bicarbonate 2.75 meq per L, phosphorus 1.9 ppm, potassium 6.7 ppm, and nitrate 3 ppm. In this study, the role of nutrients from water is considered to be minor, as fertilizer was abundantly supplied.

The 1.1 dS/m low salinity blend approximates the average EC of Colorado River water which is the primary agricultural water available in Southeastern California. The water was blended manually in the necessary proportions to achieve the desired target EC as the tanks were filled. During the blending process, the EC was measured using a YSI Ecosense® EC30A conductivity meter. The EC of the water in the storage tanks was monitored on a regular basis and refilled as needed.

To assist in maintaining a suitable irrigation regime for the trial, two tensiometers (Irrometer Company, Inc., Riverside, CA) were installed at depths of 12 and 30 inches at the base of Tree 12 to provide soil moisture readings. The trees were irrigated 2 - 3 times daily and the soil was kept close to field capacity throughout the trial. Average daily water application was 6 gal per tree.

One-half tablespoon of Agropell 15-15-15 with 10% sulfur, and one-half tablespoon of 6-4-6 Vigoro Citrus and Avocado Plant Food were applied monthly below each emitter.

Trunk diameter was measured using a Pittsburgh 6-inch composite digital caliper. with a resolution of .01 inches and accuracy of ±.01 inches. The trunks were wrapped with a 14 inch foam sleeve to prevent suckers from emerging. The top of the sleeve served as a consistent measurement point for trunk diameter growth.

This work was performed by Stephen Denis, Agronomist, proprietor of Ecosphere R&D, P.O. Box 6, Thermal CA (USA) 92274, in collaboration with Rod Chamberlain, owner of Wong Mango and Tomato Farm, Northshore CA (USA) 92254