Evaluation of the use of desalinated seaweater for irrigation of young citrus trees in the Southeast of Spain. Preliminar results

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Introduction – Desalinated seawater (DSW) has emerged as a feasible option for irrigated agriculture in some regions as the Southeast of Spain, with the highest levels of water scarcity in Europe. One of the problems of using DSW for crop irrigation is the high concentration of ions such as Na^+, Cl^- and B^{3+} than can be accumulated by the plant and cause specific injury to metabolic processes and tissues, thus reducing yields. Citrus trees, very sensitive to B^{3+}, are widely grown in the irrigation areas supplied with DSW, which increases the boron-toxicity damage risk for this crop. In addition, the low concentrations of Mg^{2+}, Ca^{2+} and SO_4^{2-} in DSW force farmers to increase them with fertilizers, increasing operational costs of fertilising. Besides that, these low Ca^{2+} and Mg^{2+} concentrations along with high Na^+, result in high sodium adsorption ratio (SAR) values, that, with the low EC of DSW, indicates moderate soil sodicity hazard. DSW is usually managed as a supplementary agricultural supply, blending it with other conventional sources. This work studies current irrigation in a citrus orchard with DSW and blending strategies together with other available water resources in semiarid areas of Spain, analysing the main physiological and agronomic concerns.

2. Experimental – A three-year-old mandarin-orange hybrid *cv.* 'Safor' grafted on *Citrus macrophylla* orchard was fully-irrigated (100% ETc) with three different type of water: DSW, water from the Community of Irrigators of Cartagena's Field (CICF), and blending of DSW+CICF, (Table I). Nutritional and physiological effects were evaluated after applying the treatments for one year. Agronomic response was also studied after eighteen months.

Table I. Chemical characteristics of the water in the irrigation treatments.

Treatment	CE (dS m^{-1})	B^{+3} (mg L^{-1})	Cl^- (mg L^{-1})	Na^+ (mg L^{-1})	SAR
CICF	1.54	0.59	270	176	4.3
DSW	0.92	0.82	227	142	5.8
CICF+CICF	1.27	0.71	248	162	4.7

3. Results and Discussion – Physiological response of trees was monthly analysed from May to October 2018. Despite not finding significant differences, stomatal conductance was always lower in DSW than in DSW+CICF or DSW-treated trees, which resulted in a lower rate of photosynthesis. Notwithstanding the slight stomatal closure, DSW-irrigated trees showed lower leaf and stem water potential during the summer than the rest of trees, lower osmotic potential and an increase of proline in their leaves. Although irrigation with DSW significantly increased leaf B^{3+} concentration by the end of the summer, these values were recovered to those found in DSW+CICF or CICF-irrigated trees in autumn. No significant accumulation of other toxic elements (Na^+ or Cl^-) was observed in leaves during the first year of irrigation with these treatments. No deficiencies of Ca^{2+} or Mg^{2+} were detected in the leaves since they were applied by the farmer as fertilizer. The differences shown on physiological and nutritional responses of trees to the irrigation with different types of water were not enough to produce differences on total fruit yield, neither in the fruit load nor in the mean fruit weight. Fruit quality was neither significantly modified by the quality of the water used for irrigation and the fruit maturation process seemed not change by the treatments.

4. Conclusions – During the first year of this study, the use of DSW did not change significantly the behaviour of young mandarin citrus trees with regard those irrigated with CICF water. Since some clues of harmful effects has been seen during this preliminary study, they will be revealed in the next future.

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