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Pickleweed tolerates irrigation with seawater and high levels of boron

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Reuse of agricultural drainage water (DW) for irrigation is one of the few on-farm water management options available to growers on the west side of California's San Joaquin Valley (SJV) for reducing drainage water volumes (San Joaquin Valley Drainage Implementation Program, 2000). Management strategies that reduce drainage volumes are attractive because they would reduce the area required for environmentally sensitive evaporation ponds and lower the costs associated with disposal of the final effluent. Moreover, reductions in drainage volume would reduce the amount of trace elements (Se, B and Mo) and nutrients reaching the San Joaquin River and would help grower's meet newly established targets for total maximum daily loads (TMDLs).

In sequential reuse systems, saline drainage water is sequentially applied on progressively more salt-tolerant crops where application of concentrated effluents to halophytes is the final step in the sequence prior to disposal or treatment. However the effectiveness of halophytes in reducing drainage volume is dependent upon their ability to tolerate extremely high levels of salinity and boron over the long term, maintain high rates of evapotranspiration, and thrive in saline-sodic conditions with poor physical conditions.

Grattan et al. conducted greenhouse experiments with Pickleweed, *Salicornia bigelovii Torr.*, a halophyte native to North American coasts and arguably one of the most salt-tolerant vascular plants. It has also sold in European markets as green tips used in salads and cooking and its seeds produce oil that is high in polyunsaturated fat.

The authors found that *S. bigelovii* grow very well over a range of salinity treatments (19-52 dS/m) comprised of either seawater or hyper-saline drainage water. Moreover, the plants were also able to tolerate high concentrations of boron (28 mg/L), an important constituent found in drainage water. The most remarkable find for Grattan and co-investigators was that evapotranspiration (ET) rates from these plants exceeded that lost from an evaporation pan by 1.5 to 2.5 times. Grattan and co-workers also developed a method to separate evaporation and transpiration by accounting for the changes in the isotopic signature of water in the reservoir due to evaporation. They found that high ET rates were due primarily to high transpiration rates (> 78% of ET).

"This finding is somewhat surprising considering this halophyte has no true leaves," commented Grattan. Although some challenges remain regarding the consistent establishment of *S. bigelovii* under field conditions, these data indicate that hypersaline drainage water, characteristic of California's Westside of the San Joaquin Valley, can be used to irrigate this halophyte and substantially reduce drainage volumes.

Source: Soil Science Society of America