Fertilizer location modifies root zone salinity, root morphology, and water-stress resistance of tree seedlings according to the watering regime in a dryland reforestation

Ovalle, J. F., Arellano, E. C., Ginocchio, R., & Becerra, P. (2016). Fertilizer location modifies root zone salinity, root morphology, and water■stress resistance of tree seedlings according to the watering regime in a dryland reforestation. Journal of Plant Nutrition and Soil Science, 179(2), 223-233. <10.1002/jpln.201500181> Accessed 28 Dec 2020.

Abstract

There is a direct relationship between soil nutrient concentration in localized zones and root proliferation and elongation under well■watered conditions. However, in field studies under semiarid conditions this relationship can change due to higher salt accumulation and soil dryness that affect root growth, water stress resistance, and seedling survival. We assessed the effect of different locations of fertilizer placement in the soil profile and water availability on root zone salinity, root development and ecophysiological responses of Quillaja saponaria Mol. after outplanting. A single dose (6 g L–1) of controlled■release nitrogen fertilizer (CRFN) was placed at 0 cm (top layer), 15 cm (middle layer), or 30 cm (bottom layer) depth in the containers in a greenhouse, in addition to an unfertilized treatment (control). After 6 months, seedlings were transplanted to the field and subjected to weekly watering regimes (2 L plant–1 and unwatered). Morphological and ecophysiological parameters were periodically measured on seedlings, as well as soil electrical conductivity (EC). After 1 year, the shoot : root ratio of unwatered seedlings decreased as a function of CRFN placement depth, which was attributed to lower shoot growth and not to greater root growth. The root morphology of the bottom layer treatment was negatively affected by high EC in unwatered seedlings. Greater total root length and root volume of the middle layer treatment was found only when well■watered; however, this did not contribute to improve physiological responses against water stress. The lowest EC and the highest photochemical efficiency, net photosynthesis, and stomatal conductance were shown by unfertilized seedlings, independent of water availability. Our findings suggest that varying depth of CRFNplacement does not contribute significantly to improve root growth under water restriction. Water supplements, independently of the CRFN location in the substrate, contribute to decrease root zone salinity, and consequently, improve root volume growth..