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Nursery location and potassium enrichment in Aleppo pine stock 2. Performance under real and hydrogel-mediated drought conditions

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Summary

This work investigates Aleppo pine performance under severe drought conditions according to seedling size and nutritional status, with special emphasis on potassium. The interaction of drought ameliorating measures such as hydrogels is also studied. Seven fertilization treatments applied in two nursery locations provided 14 stocklots, resulting in different seedling sizes for each nutrient concentration and vice versa. Stocklots were tested in a greenhouse experiment and a harsh site plantation experiment. In the greenhouse, seedlings given two hydrogel doses (0.01 and 0.1 per cent w/w) plus a control were allowed to dry and survival and soil moisture were measured. In parallel to this trial, the effects of hydrogel dosage, brand and soil texture on soil water properties were tested in a laboratory. Results show that large stock survived significantly better than conventionally sized stock in both experiments: 37 and 27 per cent more in the greenhouse and harsh site, respectively. Despite presenting wide variation, macronutrient concentration was not related to survival for a given size. Hydrogel effect on soil water was different according to factors, although in all cases, its effect diminished at suction tensions higher than 30 kPa. Results demonstrate the overriding effect of size over nutritional status on seedling survival in harsh environments.

Introduction

Forest restoration with Aleppo pine (*Pinus halepensis* Mill.) in the Mediterranean is characterized by substantial variability in establishment success mainly due to variation in site quality as well as stock quality (Alloza, 2003; Del Campo *et al.*, 2007b). The harsh conditions typical of reforestation sites have led to the development of reforestation techniques, such as intense site preparation, specific forest machinery, use of tree shelters, soil amendments and post-planting silvicultural measures to improve establishment (Pemán García and Navarro-Cerrillo, 1998). Stock

quality is an area of active research and several authors recommend specific quality attributes for Aleppo pine (Pardos *et al.*, 2003; Puertolas *et al.*, 2003; Navarro-Cerrillo *et al.*, 2006; Del Campo *et al.*, 2007a,b; Oliet *et al.*, 2009). In recent years, there is widespread agreement that larger nutrient-loaded seedlings perform better under stress conditions. In addition, when studying field performance, morphology and nutritional status should be analysed separately as fertilized stock is usually larger. However, increasing seedling size to suggested values (Navarro-Cerrillo *et al.*, 2006; Oliet *et al.*, 2009) requires important considerations at both the nursery and the field stage. The former