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## Seedling quality and field performance of commercial stocklots of containerized holm oak (*Quercus ilex*) in Mediterranean Spain: an approach for establishing a quality standard

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**Abstract** Holm oak is the hardwood most used for reforestation in Mediterranean Spain, which makes the development of stock quality standards in order to improve establishment success, a priority. However, its nursery culture is characterized by a wide range of practices resulting in stock heterogeneity and a potentially varied outplanting performance. Previous research has focused on specific seedling quality attributes, obviating the integral effect of nursery culture on overall quality. We studied growing regime, seedling quality, and field performance in nine holm oak stocklots produced in commercial nurseries during two consecutive growing years. Results proved variations in field performance were related to stocklot quality and, hence, to the growing regime practised. This dependence on stock quality may vary with planting site weather: in the drier year, survival was related to attributes like height, water status and K concentration, while, in the second, milder year, only growth performance was related to nutrient concentrations, plant size and water status. Results indicated the following quality standards for height: 12–17 cm, diameter: 3.5–4.8 mm, shoot and root weights: 1.3–1.6 and 2.8–4.7 g, respectively, N–P–K foliar concentrations: over 10–0.9–3.7 mg g<sup>-1</sup>, respectively and in water status parameters:  $E_{MX} < 5$  MPa and  $SWD_{TL} > 15\%$ . These attributes can be adjusted using nursery cultural practices in order to meet seedling quality standards for holm oak for planting across similar sites.

**Keywords** Water stress · Nutrition · Establishment · Nursery growing regime · Reforestation

**Resumen** La encina es la frondosa más empleada en España en forestación por lo que el desarrollo de estándares de calidad de planta es una herramienta básica para garantizar el

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