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## Nursery fertilization enhances survival and physiological status in Canary Island pine (*Pinus canariensis*) seedlings planted in a semiarid environment

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**Abstract** We tested the hypothesis that fertilized containerized *Pinus canariensis* seedlings increases survival when planted in semiarid sites through the improvement of their physiological status during the establishment phase by an increment in root growth. Seedlings were cultured under two different regimes: traditional (in non-fertilized natural soil) and alternative (in fertilized peat). Morphological attributes and nitrogen content were measured before planting. Measurements of survival and growth in the plantation were made periodically for 2 years and physiological plant responses (leaf water potential, gas exchange and chlorophyll fluorescence) during the third summer after planting were tested and finally a set of plants were excavated to

measure the same parameters as before planting. Seedlings cultivated using fertilized peat achieved the highest values for all of evaluated parameters. During the third dry season, big seedlings exhibited better physiological status. Therefore, enhanced root growth can result in better water uptake during the dry period thereby increasing survival and growth in the next few years after planting. A feed-back physiological model is proposed to explain *P. canariensis* establishment in a semiarid environment.

**Keywords** Canary Island pine · Fertilization · Feed-back model · Field performance · Seedling quality · Physiological status

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### Introduction

The fight against desertification in Mediterranean environments involves many strategies for tending to the ecological restoration of degraded lands. Afforestation of former woodlands is a key task to revert the degradation of Mediterranean forests by wildfires, cutting, grazing or soil erosion. However, the achievement of successful plantations has many technical problems imposed by the extreme aridity during summer. Determining the optimum characteristics features of the planting stock for such conditions is crucial.

*Pinus canariensis* is an endemic species in the Canary Islands. Natural pine forests in the Canary Islands grow under different climatic conditions with respect to elevation and geographical position. For example, in Tenerife the distribution limit is between 800 and 2,200 m a.s.l. on north facing slopes and from 500 up to more than 2,500 m a.s.l. on south exposed slopes. (Fernández-Palacios and de Nicolás 1995). A common feature of these pine forests in