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## Relationship between root growth potential and field performance in Aleppo pine

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**Abstract** — Commercial stocks of Aleppo pine in Spain vary in quality, but there is no accepted standard for evaluating quality. A RGP test was applied to six commercial seedling stocklots at two dates (November, February) and under two test conditions (growth-chamber, greenhouse). The RGP's predictive ability was evaluated on two contrasting sites. There was a considerable variation in the RGP depending on application date, test conditions and stock factors. The RGP results for November were correlated with each other but they did not explain outplanting performance. The February results in the growth-chamber correlated well with survival at both sites. Regression models explained survival both in the lower ( $R^2 = 97\%$ ) and in the higher ( $R^2 = 92\%$ ) quality sites. RGP has a valid predictive ability for this species although it is sensitive to the test conditions. In this sense, a shorter and more intensive test performed right before planting may be more reliable.

outplanting / seedling quality / site quality / prediction model

**Résumé** — Relation entre potentiel de croissance racinaire et performance du **pin d'Alep en plantation**. Les productions commerciales de plants de pin d'Alep en Espagne présentent une importante variabilité de qualité, mais aucun test standardisé d'évaluation de la qualité des plants n'a été élaboré. Un test de potentiel de croissance racinaire a été conduit sur des plants de six lots commerciaux de pin d'Alep à deux dates (novembre et février) et dans deux conditions de test différentes (chambre de croissance et serre) Le potentiel de croissance racinaire (RGP) a été évalué sur deux sites écologiquement contrastés. RGP a fortement varié avec la date, les sites de plantation et les lots de plants. Les évaluations de RGP étaient corrélées entre elles en novembre, sans expliquer les faux de réussite en plantation. Les valeurs de RGP évaluées en février en chambre de croissance ont présence de bonnes corrélations avec la survie des plants dans les deux sites. Les modèles de régression ont expliqué la survie des plants à la fois dans le site faiblement productif ( $R^2 = 97\%$ ) et dans le site productif ( $R^2 = 92\%$ ). RGP présente un fort potentiel prédictif cette espèce bien qu'il soit sensible aux conditions de test. Dans ce sens, un test plus court et plus intensif réalisé bien avant la plantation peut être plus fiable.

plantation / qualité des plants / qualité du site / modèle prédictif

### 1. INTRODUCTION

Aleppo pine is the species most used in eastern Spain (Valencia region) for reforestation programmes. Its important values are associated with landscape quality, soil protection and hydrological cycle stabilization. During the last 30 years, destructive wildfires have considerably affected their natural stands [17], which have prompted an increase in public reforestation efforts in those areas where natural regeneration has not been successful. However, the harshness of the Mediterranean climate frequently leads to high mortality rates in these programmes, with mean percentages of around 35% [1]. This has usually been attributed, in addition to other factors, to poor stock quality [19, 28]. This stock is produced in nurseries using different growing regimes, resulting in stock heterogeneity [27].

Root growth potential (RGP) is considered to be one of the most reliable tests in assessing planting stock quality

and vigour [25, 29] and has been the subject of several reviews [5,24,30]. According to Burdett [5], the relationship between field performance and RGP is so well confirmed that the lack of response in some studies may be attributed to uncontrolled experimental factors (e.g. site, planting date or stock range of variation). Recently, the empirical evidence of the test has been supported by process-based models for a wide range of environmental conditions [11]. However, the RGP results should be interpreted cautiously when using them as an indicator of seedling performance potential [9,24]. One of the test's main drawbacks is the sensitivity of the root system to cold soils during the planting season [30]. Therefore, these and other authors [5] agree that the validity of the RGP as a measurement of seedling vigour is largely a function of site conditions, with its predictive ability increasing as the site becomes harsher. In this sense, the RGP or seedling quality attributes in general might be considered good indicators of a relative performance potential [5,21].

In Mediterranean Spain, the exceptionally harsh site conditions increase the need for the production of the highest quality

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