The effect of propagation methods on some growth and physiological characteristics of seed- and vegetatively propagated *Eucalyptus* varieties

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**INTRODUCTION**

The purpose of this study was to deepen our understanding of the field performance of micro- and macro-propagated *Eucalyptus grandis* x *nitens* (GN), in comparison with seed-propagated *E. grandis* and *E. nitens*. The emphasis was on the relationship between root characteristics (hydraulics, anchorage efficiency) and above-ground parameters (survival, leaf gas exchange). Cold-tolerant GN clones are planted across low-productivity, high altitude sites in South Africa1.

**METHODS**

Propagation of saplings using established protocols establishment of a field trial Measurements: leaf gas exchange (Fig. 1A), root hydraulic conductance (k), vertical uprooting resistance (Fig. 1C), root architecture.

**RESULTS**

• Growth deformations were observed particularly from macro- (Fig. 2D, E) and micro-propagated GN (Fig. 2F, G):

After 16 months of field growth:

• drought and occasional air and soil frosts resulted in 50% survival of micro-propagated GN, compared with 98% macro-propagated GN, 93% *E. nitens* and 60% *E. grandis*;

• differences in instantaneous leaf gas exchange, and parameters derived from light- and CO₂-response curves (e.g. A, and Jₑₑₑ) were not significant across all plant types, and Yₑ was maintained above -2.0 MPa;

• differences in kₑ and Kₑ were not significant between micro- and macro-propagated GN; however, roots of the latter were 32% more efficient in conducting water to the leaves (Table 1).

<table>
<thead>
<tr>
<th></th>
<th><em>E. grandis</em></th>
<th><em>E. nitens</em></th>
<th>Macro GN</th>
<th>Micro GN</th>
</tr>
</thead>
<tbody>
<tr>
<td>kₑ (10⁰⁴)</td>
<td>2.68 ± 0.28a</td>
<td>2.18 ± 0.48b</td>
<td>2.09 ± 0.31c</td>
<td>1.69 ± 0.55d</td>
</tr>
<tr>
<td>Min: Max</td>
<td>1.50:2.39</td>
<td>1.23:3.00</td>
<td>1.58:2.54</td>
<td>1.05:2.32</td>
</tr>
<tr>
<td>kₑ (10⁴)</td>
<td>3.45 ± 1.43a</td>
<td>3.12 ± 0.803b</td>
<td>3.49 ± 3.11c</td>
<td>2.36 ± 0.793d</td>
</tr>
<tr>
<td>Min: Max</td>
<td>1.50:2.39</td>
<td>1.23:3.00</td>
<td>1.58:2.54</td>
<td>1.05:2.32</td>
</tr>
</tbody>
</table>

**DISCUSSION**

Although there were no major physiological differences between micro- and macro-propagated GN, and seed-propagated *E. grandis* and *E. nitens*, the root system yielded by micro-propagation was generally inferior, and failed to support the survival and anchorage of most saplings in the field. Macro-propagated saplings with ‘tap-sinkers’ had symmetrical and deeper lateral roots around the stem, which increased resistance to vertical extraction, similar to seed-propagated saplings. Micro-propagated saplings may therefore not be suitable for planting across sites with strong winds, and those likely to be affected by prolonged dry periods during climate change. However, the simulation of wind-loading during acclimatization of vegetatively propagated saplings could improve the development of efficient roots in terms of anchorage and acquisition of water from deeper soil layers. Nursery conditions and practices which influence root properties of saplings should be given more attention.

**REFERENCES**


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