Field Trial Results of *Acacia melanoxylon* from Tissue Culture

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INTRODUCTION

At the turn of the century, Australian blackwood (*Acacia melanoxylon*) was a very popular cabinet making timber, but supplies diminished and other timber took its place in the market Since the early 1980s, it has attracted interest in New Zealand as a special purpose plantation tree, an alternative to local native timbers which have become expensive and not widely available (Nicholas, 1982). *Acacia melanoxylon* grows on a wide variety of sites and it is possible to achieve the desired 6-m sawlog with a 30-40 year rotation.

Acacia melanoxylon often exhibits a poor form, usually as the result of insect damage to shoot tips causing loss of apical dominance. Within stands of *A. melanoxylon* good trees exhibiting rapid growth and improved form can be recognised. The Forest Research Institute (FRI) *Acacia melanoxylon* Programme includes silviculture, breeding and propagation research. Tissue culture was included in the propagation research as it had the potential to provide an early amplification of limited seed and cutting material which could then be multiplied further using less expensive cutting techniques. Furthermore, tissue culture could facilitate the import of desirable proven clones *in vitro* from Australia and South Africa where some selection work had already been done.

Early tissue culture research with *A. melanoxylon* at FRI has been reported (Jones, 1986; Jones and Smith, 1988). Results are presented from a preliminary field test of micropropagated *A. melanoxylon* one year after planting.

METHODS

Plant Material. *Acacia melanoxylon* seed (Jubilee Creek, South Africa seedlot number 8/0/84/10) was sterilized and germinated *in vitro* October 1986. Tissue culture techniques to produce plantlets have been described previously (Jones, 1986; Jones and Smith, 1988). These methods deal with the *in vitro* stages. In June 1988, rooted *A. melanoxylon* plantlets from 3 clones were removed from sterile culture, washed, root trimmed, and potted into 4 × 4 cm peat pots containing a peat:perlite:pumice mixture (2 1.1, v/v/v). Plantlets were placed inside a plastic frame in a glasshouse and misted each day. After three weeks, new foliage growth was visible on the tissue-cultured plants, which were then hardened off with increasing exposure to ambient conditions. Also in June, seeds from the same seedlot were sown in a hygiene tray and seedlings pricked out into root trainers (4 × 4 cm) after 14 days and grown in the same glasshouse as the tissue-cultured plantlets.

Plantlets and seedlings were lined out in a nursery bed at 8 × 8 cm spacing in November 1988 In June 1989, plants were conditioned by undercutting, wrenching and lateral root pruning. Due to unavoidable circumstances, a field trial was not established until November 1989, three months further into spring than considered optimal.

Site Preparation and Plot Design. The site was on the FRI Campus at Rotorua and was prepared by ripping to a depth of 50 cm at 2m centres. Plants were root trimmed and planted at 2 × 2m spacing. There were 4 plots each containing 68 trees giving a total of 272 trees in the field trial. Due to the late planting, tops were cut off all plant types to reduce water stress caused by lifting Therefore heights at planting were less than heights in the nursery bed Plants were measured in the nursery bed (June 1989), at planting (November 1989), and one year after planting (July 1990) for height and diameter.

In June 1989 at the time of conditioning in the nursery bed, two of the tissue-cultured clones (clones 2 and 4) exhibited plagiotropic growth. This growth orientation with the main stem lying horizontal rather than vertical, seriously affects both form and ability to compete with weeds following establishment.

All signs of plagiotropic growth had disappeared one year after planting. Heights were measured to the tip of the tallest branch and diameters were taken at the root collar at planting and after one year in the field.

Statistical Analysis. Plot 2 had a single tree random plot design including three tissue cultured clones and the seedling control. Data were analysed by one-way analysis of variance using Genstat 5. Means were compared using the LSD test at 5% level of confidence. Plots 1, 3, 4 were not analysed; they had one plant type per plot (P1=seedlings, P3=cl. 4 and P4=cl. 2.)

RESULTS

In the nursery bed, the heights of the 4 plant types were significantly different with Clone 3 being the tallest (Figure 1). At planting the seedlings and Clone 3 were significantly taller than Clones 2 and 4 despite topping. The same pattern remained one year after planting but the difference was no longer significant.

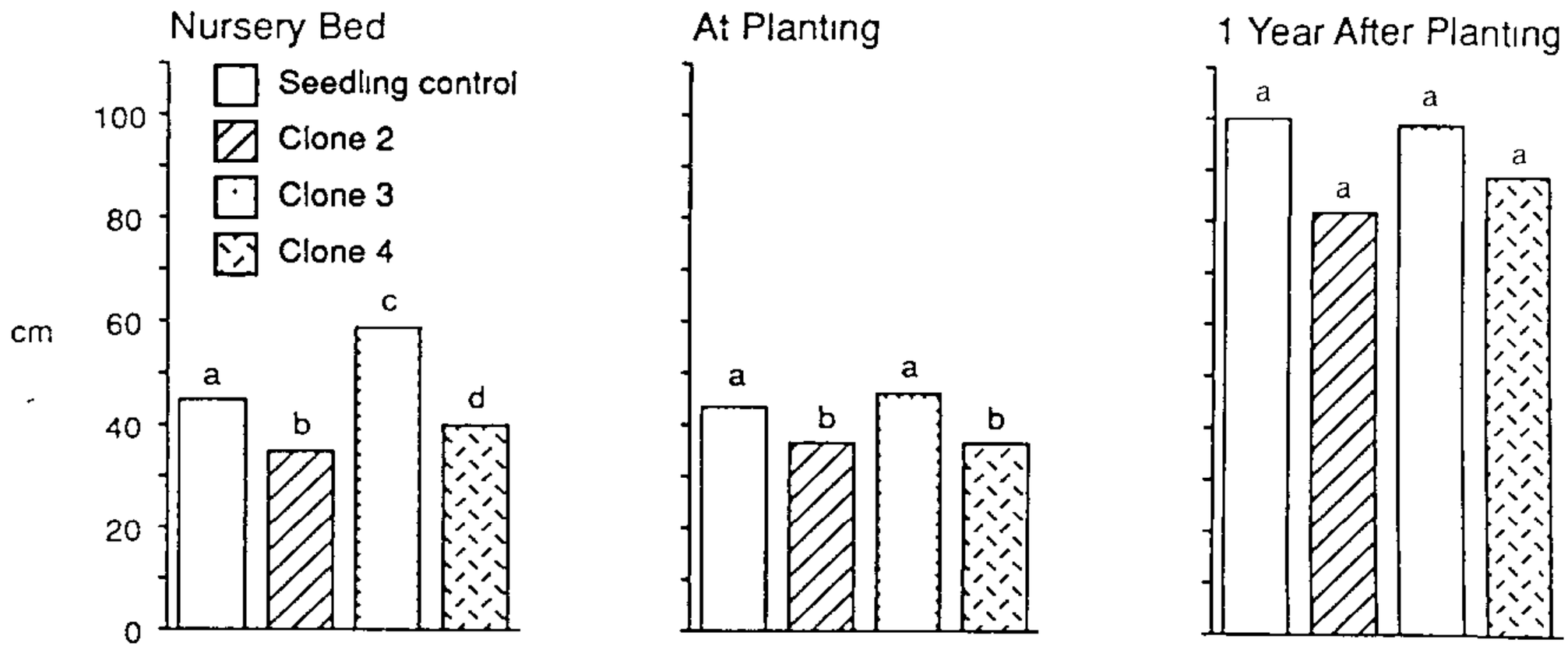

Figure 1. *Acacia* field trial heights.

Diameters at planting and one year after planting showed trends similar to those for height, with seedlings and Clone 3 significantly larger than Clones 2 and 4 (Figure 2) at planting. One year later, there was no significant difference between the diameter of the four plant types

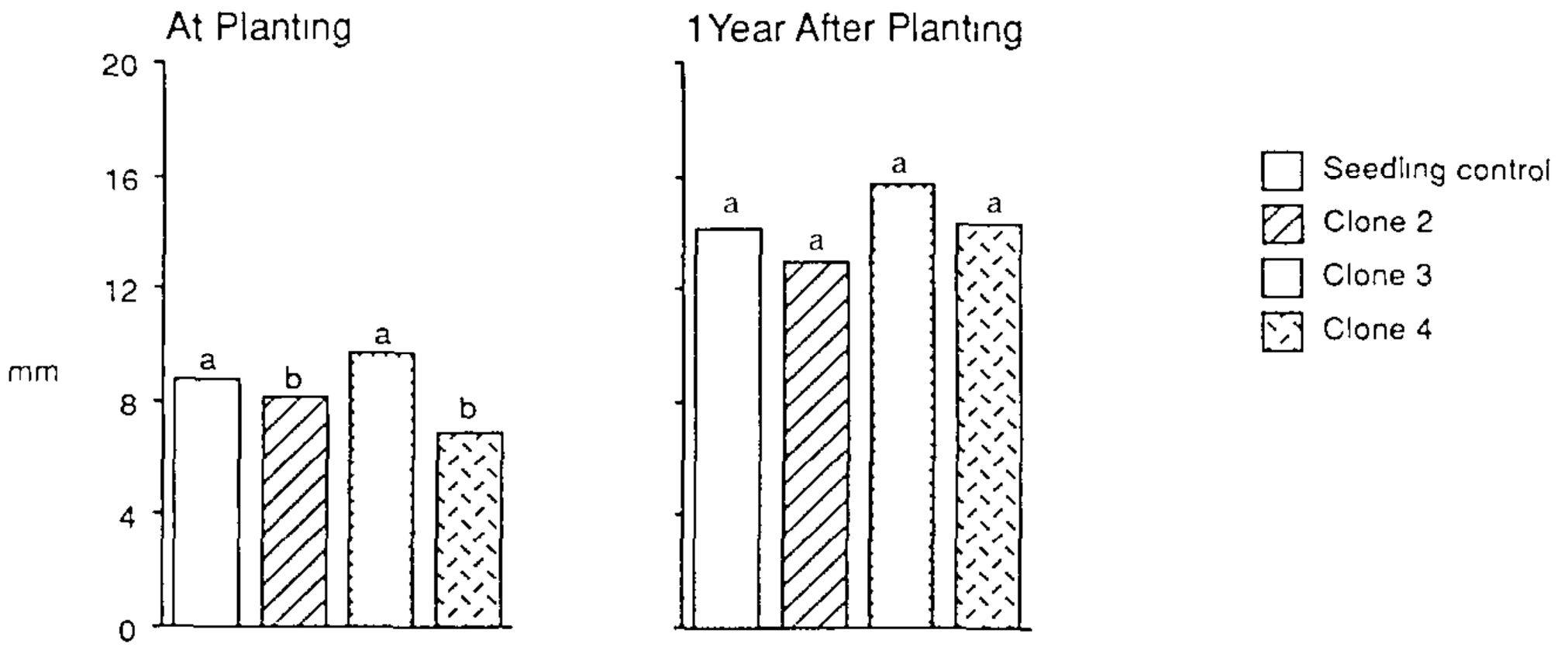

Figure 2 *Acacia* field trial diameters

There was no significant difference in height increment between the four plant types (Figure 3) Clone 2 tended to be shorter, but due to a wide range in heights 56-104 cm, this was not significant. However, diameter increment for Clone 4 was significantly greater than that for the other 3 plant types.

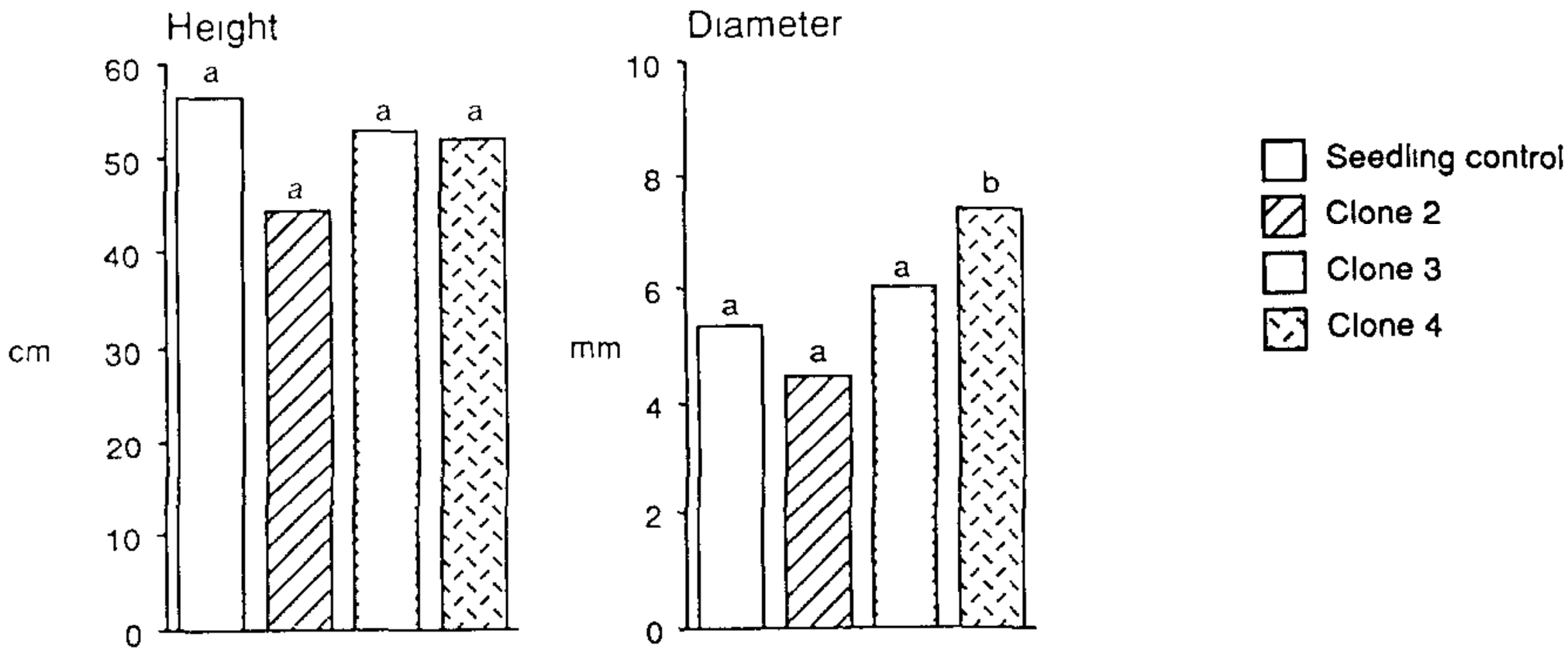

Figure 3. *Acacia* field trial height and diameter increment at 1 year

DISCUSSION AND CONCLUSIONS

Tissue culture has potential as a propagation method for early amplification of limited material (for some clones up to 1,000 in a 6 month period). The tissue-cultured planting stock used in this trial had a similar growth rate to seedlings. Although the tissue-cultured plants were not considered to have as good a root-shoot ratio as the seedlings at the time of lifting, this preliminary trial shows that three randomly selected clones were not inferior to seedlings in the critical first year following field planting. Subsequent field measurements are necessary to follow the growth of the *A melanoxylon* plantlets.

Conventional propagation research initiated at the same time as the tissue culture research has proved very effective, with many plants produced from root cuttings from young and old material. At this stage, tissue culture will not be used for amplification of select material within the FRI. However, the potential has been demonstrated by this study Should tissue-cultured plants become a preferred planting stock because of benefits such as high initial multiplication rates, further attention to nursery management techniques would be beneficial.

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