Propagation Media and Rooting Cuttings of *Eucalyptis grandis*

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Cuttings of *Eucalyptus grandis* placed in four different propagation media, sand, peat, perlite or a mixture of sand, peat, perlite (l:l:l v/v/v), showed best rooting in the mixture. Examination of the physical characteristics of the four media suggested that relatively high moisture content may be more important that high air content for maximum root formation. Sterilizing the propagation medium did not improve rooting percentage but did increase the number of roots.

INTRODUCTION

Rooting of cuttings is influenced by the type of propagation medium used. The physical structure of the materials can affect the micro environment around the base of the cutting, particularly in respect to air and moisture content; both factors are known to influence root formation on cuttings (Hartmann and Kester, 1975; Loach, 1988).

Cuttings of *Eucalyptus* species are reported as having been successfully rooted in a range of media, including peat, sand, vermiculite, rockwool, loam and mixtures of some of these (Chaperon, 1983; Cunningham and Geary, 1989; Geary and Lutz, 1985, Reuveni, et al., 1990; White, 1986). The reasons for using these media have not been given and the physical characteristics that contribute to their success or failure as propagation media have not been described or discussed.

Nursery hygiene, also, is important for successful production of large numbers of rooted cuttings New cuttings are susceptible to stem infection and their treatment with fungicides is a recommended part of nursery practice However, there does not appear to have been any published evaluation of the need to sterilize propagation media to reduce pathogen activity.

In the experiments reported in this paper, cuttings of *Eucalyptus grandis* Hill ex Maid were rooted in four different media with different air and moisture contents. The rooting response was evaluated in relation to physical characteristics of the media. The effects of media sterilization on rooting of *E. grandis* cuttings was also examined. All work was done using the glasshouses and facilities at the Plant Culture Facility, Australian National University, Canberra.

MATERIALS AND METHODS

The cuttings were from container-grown *E. grandis* stock plants of a single clone. The stock plants were greenhouse grown at 15°C night, 25°C day under natural photoperiod and irradiance, and pruned to maintain a single stem to 50 cm high with many lateral shoots.

To study the effects of medium composition on rooting, four different media were used. coarse river sand, European peat, perlite, and a mixture of peat, perlite and sand (1:1:1 v/v/v). Each was measured for volumetric air content and total moisture content using techniques described by Handreck and Black (1989).

Trials commenced in February 1990. Cuttings were prepared from the basal sections of 10 week old shoots. Each shoot had four leaf pairs. The two basal pairs were removed and the upper leaves cut in half. The base of the cutting was at a point immediately below a node and the basal two centimetres of the cutting were treated with liquid 8000 ppm IBA (10 second dip) The IBA solution was allowed to evaporate before the cuttings were inserted into the propagation media Pots containing the cuttings were placed in a propagation unit with basal heating (20°C), humidity control (85%) and air temperature control (20°C night, 30°C day).

Eight weeks after sticking, the percentage rooting, number of primary roots per rooted cutting, and dry weight of the root mass per cutting were determined.

In the medium sterilization study, cuttings were set in sterilized and non-sterilized mixtures of peat, perlite, and sand (1:1:1 v/v/v). The sterilized mixture had been autoclaved (120°C for 30 min at 95 kPa). The cuttings were prepared in the manner previously described. Seven weeks after sticking cuttings were assessed as described above.

RESULTS

Rooting of cuttings was influenced by the medium used, and the best rooting (83%) was observed in the peat, perlite and sand mixture (Table 1). Cuttings in peat rooted better than those in perlite or sand.

Root number and root-mass dry weight per rooted cutting also varied with medium Cuttings in the peat, perlite, and sand mixture clearly had more roots and a larger root-mass dry weight than cuttings in the perlite or the sand but the differences from peat were less pronounced (Table 1). Root mass per rooted cutting in the mixture or the peat was about twice that for cuttings in perlite or sand.

Table 1. Rooting response of *Eucalyptus grandis* cuttings in four media with different air porosity and moisture contents

Media	Rooting[1] (%)	Primary root number per rooted cutting	Root mass per rooted cutting (mg)	Volumetric air porosity (%)	Moisture content (%)
Peat Perlite Sand	83	2.3 a[2]	44 a	11	55
Peat	40	1.9 ab	42 ab	20	60
Perlite	25	1.4 bc	22 bc	39	42
Sand	20	0.4 d	19 c	8	25

[1] 40 cuttings per treatment

[2] Within a column numbers followed by different letters are significantly different at the 5% probability level

The successful peat, perlite, and sand mixture had a moisture content of 55%, relatively high compared to that of the least successful sand, which had a moisture content of 25% (Table 1). However, the air-filled porosity of these two media was similar (11 and 8% respectively) and much lower than that of the peat and perlite (20 and 29% respectively) These results suggest that water content may be more important than air content as an influence on rooting of *E. grandis* cuttings In contrast there seemed to be no relationship between air porosity and rooting percent. The air porosities of the peat, perlite, sand mixture and the sand were similar yet cuttings in the mixture rooted approximately four times better than cuttings in the sand (Table 1)

Sterilizing the propagation medium did not change rooting percentage but did increase the number of roots produced. The cuttings in the sterilized medium had

Table 2. Rooting response of *Eucalyptus grandis* cuttings to sterilized and non-sterilized propagation media (peat, perlite, sand 1 1·1 v/v/v)

Treatment	Number of cuttings	Rooting (%)	Primary roots per rooted cutting	Root mass (d w t) per rooted cutting (mg)
Sterilized	40	95	4 9 a[1]	9 a
Non-Sterilized	40	95	1 9 b	12 a

[1] Within a column, numbers followed by a different letter are significantly different at the 5% probability level

an average of 4 9 primary roots, compared to 1 9 on cuttings in the non-sterilized medium (Table 2). Roots in the sterilized medium, although more numerous, were smaller than the roots in the non-sterilized medium

DISCUSSION

Rooting percentage and root growth of *E. grandis* cuttings varied with the type of propagation medium used. This indicates the need to carefully evaluate media for their suitability for striking cuttings of eucalypts Our studies have shown a mixture of peat, perlite and sand to be superior to any of these materials used alone. Possibly other media with physical characteristics similar to the mixture of peat, perlite and sand would be suitable and they could be made using other materials such as bark, sawdust, rice hulls or vermiculite, provided the final product has a suitable water content

Our results have indicated that for eucalypt cuttings the propagation medium should have a water content of at least 50 percent. However, as Loach (1985) suggests, it may not be possible to quantify exactly what moisture content is ideal as this may vary according to the type of propagation facility used (mist or fog) or the season in which the cuttings are rooted (winter or summer).

The relationship between successful rooting and water content of the medium is consistent with the contention of Grange and Loach (1983) that for optimal rooting, stem tissue must not loose water. Water is lost from stem tissue by transpiration through leaves and can be replaced by uptake through the stem base, so long as water is present and freely available in the medium around the base of the stem (Leakey, 1985).

Our trials comparing sterilized and non-sterilized media suggested that microbes antagonistic to root formation or development were present in the non-sterilized medium. Microbial activity in the non-sterilized medium may have acted to break down the applied IBA before it could act on responsive stem tissue or the microbes may have infected and inhibited growth of emerging root primordia. Whatever the explanation, the result of media sterilization was a very fibrous root system highly suited to production of eucalypts in small containers. If one or two dominant roots grow in a spiral fashion around the walls of the container, field establishment problems of eucalypt seedlings can result. This problem can be minimized if the plant has a fibrous root system and our results have shown such a root system can be produced on eucalypt cuttings propagated in sterilized media.

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