

Vegetative Propagation of Some *Eucalyptus* Species[©]

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INTRODUCTION

Mass vegetative propagation of some species of eucalypts is now an accepted part of plantation forestry worldwide. In Australia, we have been slow to adopt the process until recently, due to an escalation in the rate of hardwood plantation establishment and the need to increase productivity. Not all of the eucalypts lend themselves to this form of propagation and some that can be, often have low rates of rootability. This factor coupled with the cost of labour in Australia, in comparison to our forestry competitors in other countries, has led to the search for clones with high rootability and propagation techniques and nursery practices that will allow us to be globally competitive. This paper attempts to look at the process involved and the options we have available to us to achieve these goals.

HISTORY

As it should be, Australia seems to be the location where the first rooted cuttings of eucalyptus were successfully propagated. This was achieved by Fielding in 1948 and both he and L.D. Prior went on to set shoots cut from seedlings of several species, using mist sprays and bottom heat (Eldridge et al., 1993).

A French forester Bouvier, working in Morocco, discovered by chance that trimmings from 25-30 cm *E. camaldulensis* seedlings that were being prepared for transplanting, rooted easily into the ground where they fell after just a few days. As a result of this observation, by the mid 1950s several thousand rooted cuttings had been planted in nearby forests.

From this point in time a number of countries went on to adopt the process including the Congo, South Africa, France, Portugal, and more recently Chile and Brazil. Closer to home, mass propagation of *E. deglupta* was undertaken in New Guinea by J. Davidson in the late 1960s, this species being by far the easiest of the eucalypts to propagate from cuttings and is also able to be propagated from crown material rather than adventitious shoots.

A further and perhaps dominant reason for the adoption of these techniques was the advent of eucalypt hybrids. Controlled pollinations of crosses between *E. grandis* × *E. deglupta*, *E. grandis* × *E. urophylla*, *E. grandis* × *E. saligna*, and now even *E. camaldulensis* × *E. globulus*, have necessitated the adoption of vegetative propagation to maintain the F₁ hybrid.

TECHNIQUES

It is necessary to understand some of the language of clonal forestry. An ortet is the original tree, propagated sexually, from which a clone is derived. This tree would be an outstanding individual and has been selected using a number of breeding criteria. A ramet is an individual member of a clone.

In all but one of the eucalypts that can be vegetatively propagated, juvenile material produced from coppice shoots of the ortet is used initially. These ramets are transferred to a clone bank that will then be used for the production of cutting material for mass propagation.

Clone banks can be grown a number of different ways: in the ground, in plastic bags with drip irrigation, or as clonal mini-gardens. Cuttings can be taken as macro or mini depending on the propagating facilities available, the method by which the ramets have been grown, and the species. The vigour and vegetative condition of the ortet and ramet and the environmental conditions, within which the propagating is taking place, will have a bearing on the time taken to produce roots and the eventual percentage of cuttings that strike.

Year-round production is possible in nurseries based in South America, South Africa, and Australia, above the tropic of Capricorn but in more temperate climates, i.e., Chile, Portugal, and southern Australia, it is necessary to propagate in greenhouses using bottom heat and in some cases supplemental light. Without these conditions the production season is limited to the warm months of the year and outside growing of clone banks can also be limited depending on minimum winter temperatures.

In all cases the process by which cuttings are taken from the ramets, their handling while being taken to the propagating area, and storage while awaiting propagation are critical. As with all plant propagation, hygiene in the propagating area, sterilisation of the cutting material, and the use of sterile medium are of paramount importance. Cutting material can be taken from the clone banks if they are in the ground as branches, placed in buckets of water for a limited period of time, and the cuttings made from them in the propagating area prior to sticking.

In the case of clonal mini-gardens, the cuttings are actually made at the time of harvesting, placed into polystyrene coolers with a frozen ice brick, and then conveyed immediately to the propagating area for further treatment and sticking, only enough material is taken for a days propagation. Once they reach the propagating area, the cuttings are usually immersed in a solution of fungicide, drained, and then treated with hormone immediately before sticking.

The application of hormone, usually 1% to 5% IBA, is carried out in a number of ways: (1) either as dust or gel applied to the extreme basal end of the cutting; (2) with the cuttings totally immersed in a hormone solution just prior to sticking; (3) with clonal mini-gardens, introduced to the root zone of the ramets via a drip irrigation system, 24 h before the cuttings are harvested.

Propagating medium usually is made from varying proportions of peat, pine bark, vermiculite, and perlite according to each individual propagators recipe and the availability of components in each particular location. Steam sterilisation is also carried out at some nurseries to ensure the exclusion of harmful pathogens.

Containers vary in volume and shape but in the majority of nurseries involved in this work, the cuttings are stuck into individual cells in a framework holding anything up to 100 containers. This system facilitates the sorting process that will take place after misting, eliminating those cuttings that have not struck and replacing them with struck cuttings. The containers are emptied, washed, and then used again.

In the propagating area, mist or fog or in some locations both of these systems are used as the means of preventing desiccation. In warmer climates, fog is used in the upper part of the greenhouse to dump heat while intermittent mist is used over the cuttings themselves. The period of time the cuttings are under mist will vary according to species and the time of year. Roots normally appear from 6 days on subtropical hybrids and up to 14 days on temperate species, such as *E. globulus*, in the latter case with a minimum of 20°C bottom heat.

Once the cutting has a functional root system and new shoot growth is observed, then weaning from the mist can take place. This process can be carried out in a number of ways but is usually carried out under 50% to 60% shade with coarser mist than in the propagating house; the propagating house controller can be used to control misting frequency in this area as well. When the axillary buds develop their first pair of leaves, the rooted cuttings can be moved out into full sunlight and then grown on for a further 10 to 12 weeks using normal irrigation practices, they will then be ready for field planting.

CONCLUSIONS

It can be seen from the description of the process that it is highly labour intensive. Australia has a relatively high living standard in comparison to those countries with large clonal eucalypt programs, where wage rates are often 60% lower. In addition, the economic viability of eucalypt cutting production is highly reliant on the percentage rootability of each individual clone in the program. In *E. globulus* this can be as low as 50% and as high as 95% in *E. grandis* hybrids.

The cost of clonal cuttings to the trade in Australia at present is approximately double the cost of a seedling produced from elite seed. This additional cost, therefore, must be outweighed by gains in productivity, i.e., volume per hectare per year, fibre density, and fibre quality for pulp logs and diameter, and wood quality for saw logs. At present, except for two or three specialty planting programs, there is still a trade preference for seedlings, due largely to cost. Further, most of the clones under propagation in Australia, at this time, are imported from overseas companies. The process of importation and quarantine is expensive and time-consuming, it also places by default, a question mark over the narrow genetic base with which we are working.

The industry needs to have access to Australian produced clones and at the same time develop more efficient ways of mass propagation of this material. The adoption of some of the processes developed by overseas nurseries, in conjunction with our own ingenuity will ensure that we remain competitive.

LITERATURE CITED

Elderidge, K., J. Davidson, C. Harwood and G. van Wyk, 1993. *Eucalypt domestication and breeding*. Oxford University Press, New York.