This article was listed in Forest Nursery Notes, Winter 2008

171. Root systems in cutting-raised *Eucalyptus* species are influenced by cutting size and stock plant treatment. Cliffe, D. O. International Plant Propagators' Society, combined proceedings 2006, 56:78-79. 2007.

Root Systems in Cutting-Raised *Eucalyptus* Species Are Influenced by Cutting Size and Stock Plant Treatment©

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INTRODUCTION

Conventional vegetative propagation of some *Eucalyptus* species has been carried out for some 50 years, although until relatively recently only on a small scale. The exploitation of the genera by countries other than Australia for the purposes of producing high-grade paper pulp have led to the development of a range of hybrids suited to particular environments and soil types.

The main concentration has been with subtropical hybrids particularly in Brazil and more recently temperate species in Chile, Uruguay, Portugal, and Spain. Selection of clones with high percentages of rootabilty combined with desirable growth rates, form, and fibre quality, is an ongoing process within the industry.

During the last 10 years, a great body of work has been undertaken especially in Brazil, where novel propagating systems have been developed to enable nurseries to mass produce clones. These techniques and some clones have been transferred to Australia and further adapted to suit local conditions.

STOCK PLANT PRODUCTION

When vegetative propagation of *E. globulus* in commercial quantities was first undertaken, stock plants were grown in the ground and kept juvenile and macro cuttings were taken from them. This practice still persists, in particular with *E. globulus* and to some degree with subtropical hybrids such as *E. grandis X E. camaldulensis*, *E. grandis X E. saligna*, *E. grandis X E. urophylla*, and a range of others.

In Brazil, during the last 10 years, a different method of growing and treating stock plants has evolved. This technique, which incorporates the use of irrigated sand beds or ebb and flow benches and stock plants grown at very high densities per square metre in so called "mini gardens," produce what are known as mini cuttings. With this system stock plants are again kept juvenile with cuttings being taken weekly to ensure that no lignified material forms on the small stump of each plant.

We have further adapted the system to incorporate the use of coir-filled bags rather than either sand beds or ebb and flow troughs and use a system of controlled, nonleaking drippers to irrigate the plants. Using this method, conventional benching can be utilised, and unlike an ebb and flow system, but similar to sand beds, nutrient solutions "run to waste" rather than being recycled.

NUTRIENT TREATMENT OF STOCK PLANTS

Using any of the systems described above, it is important to ensure a nutrient regime which will invigorate the stock plants so that they continue to produce vegetative material from which new cuttings can be taken. In addition, it is of particular importance to ensure there is a balance of macro- and micronutrients supplied to the stock plants, on a continual basis, to ensure their ability to produce vegetative material capable of producing roots.

In a number of Brazilian and Uruguayan nurseries, some of which produce cuttings as both macro and mini, no rooting hormone is applied to mini cuttings prior to sticking. With rooting percentages in the high eighties and low nineties being achieved from mini cuttings grown under this regime, it seems evident that proper stock plant management is negating the need for hormone application and thus another process in the system. At one nursery I have visited in Brazil, rooting hormone was injected via the drip irrigation system into the sand beds 24 h prior to cuttings being taken.

The use of supplementary lighting according to the particular latitude of the nursery as it influences day length is an addition that is still under review at the time of writing. Supplementary lighting may have an effect on cutting production and potential root ability; however there is a high capital and running cost involved. Further work is needed on this concept.

PROPAGATION AND ROOT DEVELOPMENT

Mini cuttings are taken from the stock plants and in our case made at the bench. They are stored in polystyrene containers containing frozen bottles of water and collected regularly by the "sticking" crew. They are then stuck into a seedling tray and placed under intermittent mist. Bottom heat is applied during cooler months.

Callus appears at between 12 to 18 days dependant on the clone and temperature conditions. At 28 days the cuttings are removed from the mist house, put through a transitional greenhouse, and then transferred to the final container.

DIFFERENCES IN ROOT DEVELOPMENT, MACRO VS. MINI

It is quite evident that mini cuttings taken from both *Eucalyptus* species and *Eucalyptus* hybrids and managed under a controlled nutrient regime at high densities per square metre produce a superior root system to those cuttings taken as macros from plants either grown in-ground or in other types of containers but without the benefit of an adequate nutrient programme.

We have also noticed that when partially lignified cuttings are taken from stock plants managed for mini cutting production, root development is inferior to those cuttings taken at the correct time and before lignification commences.

Comparisons of root systems between plants produced from mini cuttings, macro cuttings, and seed show quite clearly, if the seedling is used as the benchmark, that mini cuttings can produce a plant with a root system equal to that of a seedling and superior to that of a macro cutting.

CONCLUSION

The successful vegetative production of *Eucalyptus* species and hybrids is highly dependant on clone selection, stock plant management, timing of harvesting cuttings, and propagation processes.

Strong evidence now suggests that the use of mini gardens to produce mini cuttings, yield propagules superior to other methods of vegetative propagation and eventually plants with superior root systems, at least comparable to that of a seedling.

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