

Commercial Forestry Cuttings in South Africa: A Tale of Two Systems[©]

Iain M. Thompson

NCT Forestry Co-operative Limited, Forest Technology Services, P.O. Box 1445,
Pietermaritzburg, 3200, South Africa
Email: iain.thompson@icfr.ukzn.ac.za

INTRODUCTION

The commercial forestry industry in South Africa has a large positive effect on the country's economy. The forestry industry is one of the larger providers of rural employment in South Africa and workers in the plantation sector number over 75,000. The forest products sector is the fourth largest manufacturing division in the country and the forestry sector, as a whole, provides employment to approximately half a million South Africans, a figure that is expected to increase as South Africa moves deeper into the 21st century (Jones, 1994; Tewari, 2001).

Approximately 1.1% of South Africa's total surface area is made up of commercial plantations, comprised mostly of exotic species and covering an area of over 1.28 million ha. However this area is decreasing, whilst processing capacity continues to grow (Department of Water Affairs and Forestry, 2003; Department of Water Affairs and Forestry, 2007). The continued success of South African forestry thus relies on an increase in production per hectare. Improved silviculture methods, the introduction of alternative species, tree improvement, and site species matching have all been successfully applied to the forestry industry and are all jointly responsible for increasing the competitiveness of the South African forestry industry (Department of Water Affairs and Forestry, 2003; Department of Water Affairs and Forestry, 2007).

The planting of clonal hybrids, particularly interspecific *Eucalyptus* hybrids, has helped increase plantation productivity (Potts and Dungey, 2004). Mass vegetative propagation is an important method to ensure the successful large-scale deployment of superior hybrid clones (Assis et al., 2004). This paper follows two very different techniques of macropropagation utilised in two commercial forestry nurseries: Sunshine Seedlings and Top Crop.

Sunshine Seedlings and Top Crop are both situated in the KwaZulu-Natal midlands on the outskirts of Pietermaritzburg. Both nurseries have large clonal programmes and produce over 1 million *Eucalyptus* cuttings per annum. These cuttings are predominantly *Eucalyptus grandis* × *E. nitens* (G×N) hybrids, but *E. grandis* × *E. urophylla* (G×U) hybrid production is increasing and now represents a significant percentage of total clone sales. Whilst the two nurseries are competitors, they have a "seek and share" mentality and often interact and share information.

STEM MACRO-CUTTINGS AT SUNSHINE SEEDLINGS

The macro-cutting system has worked well at Sunshine Seedlings in the past and continues to produce good quality clones. The macro-hedges are grown outside, at an espacement of 36 stems per m² and kept to a height of 30 cm; irrigation by sprinklers is used to supplement natural rainfall. Shoots are harvested from the

macro-hedges, placed in water, and transported to the cutting room. In the cool, moist environment of the cutting room, traditional stem cuttings consisting of 2 nodes, an internode, and 2 leaves (trimmed to reduce transpiration) are prepared. Before setting, cuttings are washed in dilute Di-1-p-menthene, to further reduce transpiration. Cuttings are dipped in auxin powder and then placed into the centre of Unigro® 128 tray cavities that are filled with rooting media. The rooting medium consists of a mix of coir (palm peat), vermiculite, and perlite at a ratio of 5 : 3 : 2 (by vol).

After setting, the trays are placed on the heated floors of a rooting tunnel. The rooting facility is a completely enclosed tunnel with a roof covered with a UV-diffused plastic and sides made of white polyweave. The floor of the facility is concrete that is heated by a manifold of pipes containing hot water. A wetwall together with an extraction fan and two circulation fans reduce the tunnel temperature when air temperatures exceed 30 °C during the hot summer months. The facility is irrigated by misters, which are operated on an unequal timer and set manually according to weather conditions. Cuttings remain in this facility for 4 to 6 weeks, depending on the season, and are then moved to an acclimatisation facility for hardening off.

The acclimatisation facility is a completely enclosed tunnel consisting of a roof of UV-diffused plastic and sides covered with green shade netting (80% shade) to prevent wind damage, whilst allowing some airflow. The facility is irrigated by sprinklers, which are operated for 1 min every hour. The trays containing the cuttings are kept off the ground by placement on concrete blocks, to induce air-pruning of the roots. After 4 to 6 weeks the rooted cuttings are consolidated into full trays and moved to a hail-net facility where they remain for 4 weeks before they are sold. The whole process from cutting to sale takes between 12 to 16 weeks.

TIP MICRO-CUTTINGS ROOTED AEROPONICALLY AT TOP CROP

In complete contrast to Sunshine Seedlings, Top Crop utilise aeroponic rooting and stem micro-cuttings to propagate *Eucalyptus* hybrids. The micro-hedges are grown inside a plastic-covered tunnel, at an spacing of 80 stems per m². The rammets are kept as low as possible and are planted into holes made in weed matting. Irrigation is provided by overhead sprinklers and shoots are harvested from the micro-hedges, placed in water, and transported to the cutting shed. In the cool, moist environment of the cutting shed, tip cuttings are placed, without media or hormone treatment, into inverted 338-cavity polystyrene trays.

After setting, the trays are placed on the heated floors of a rooting tunnel. The rooting facility has open sides to encourage airflow and has a roof covered with a UV-diffused plastic. The floor of the facility is concrete which is heated by a manifold of pipes containing hot water. No wetwall or extraction fans are installed as the open sides and narrow dimensions ensure good airflow. The facility is irrigated by misters, which are operated on a conductivity timer. Cuttings remain in this facility for 2 to 36 weeks, depending on the season. After rooting the cuttings are transplanted into 128 polystyrene trays filled with coir and bark (1 : 1, v/v) and are placed under shade netting for hardening off.

The acclimatisation process at Top Crop is a multi-phased procedure. The trays are kept on gravel floors and under shade netting. The rooted cuttings receive misting irrigation for the 1st week of the hardening-off stage, thereafter watering is reduced until by the 3rd week when the cuttings are receiving the normal seedling

water requirements. After 3 weeks the rooted cuttings are moved to a different tunnel, which is a completely enclosed structure, and receive nutrients for the 1st time. The cuttings remain in the tunnel for 2 to 3 weeks; afterwards they are moved to a hail-net facility where they remain for 3 to 5 weeks before they are sold. The whole process from cutting to sale takes between 10 to 14 weeks.

CONCLUSIONS

Top Crop and Sunshine Seedlings utilise two very different systems to produce the same product. Both systems are capable of producing a top quality rooted cuttings and have different advantages. Sunshine Seedlings' more traditional system is very robust and is well suited to the rigours of an unskilled labour-force, because it lacks a transplanting phase and the plant material is only handled once during the setting of the cutting. Top Crop's system on the other hand offers a quicker and higher root strike rate and the hedge plant conditions are more easily controlled. Also due to the lack of a hormone treatment these costs are eliminated.

Whilst competitors, Mike Kruger of Top Crop and Bryn Pollard of Sunshine Seedlings have shared ideas over the years and many of these ideas have resulted in improvements to their respective clonal practices. A few years ago Sunshine Seedlings adapted the tunnel-grown micro-hedge method and currently more than half of their hedges are housed in tunnels. Sunshine Seedlings is now investigating methods of utilising tip cuttings, whilst retaining tray setting practices. Top Crop has refined their hardening-off process with the help of feedback from Sunshine Seedlings. In short, the two nurseries are excellent innovators and have a progressive outlook towards the sharing of information for mutual benefit.

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