Three-dimensional Air Root Pruning©

Peter Lawton
Trentcom APS P/L, PO Box 44, Berwick VIC 3806 Australia

What is three-dimensional (3D) air root pruning?

Root tips growing outward and downward are guided to open-ended cusps in the container wall [and floor] and desiccate (Whitcomb, 1988). Several new roots emerge and grow to adjoining cusps and desiccate. The process repeats again and again. The rate of root tip development becomes exponential until all of the media pore space is used up. The growth of roots and the above ground tree reach equilibrium.

The Australian market for advanced trees is about 1 million trees per year that sell for about AUD$100 million. Advanced trees are 2 to 5 years old. The use of 3D air root pruning is a well-established practice in growing advanced trees. Vending bags are lowering grower costs.

PROBLEMS?

Advanced tree growers continue to be critical of the quality of some of the materials they are receiving from propagators. I was a tree grower who lost a lot of money a decade ago as the direct result of root deformities in propagated stock. Today, many advanced tree growers will not buy propagated stock in any smooth walled container for fear of hidden root deformities. Advanced tree growers have to answer for tree performance for years.

Trees purchased in 2003 still show root circling at 50 mm in both ex-ground and container-grown evergreen stock. How can faults like this be allowed to continue? Large sums of money and legal liability issues are at stake. Is there any reason why all participants in this industry should not have zero tolerance of defects — like the appliance and automotive industries? Or should we all follow a set of standard procedures — like the medical profession?

TRIALS

There must be an elegant solution to these problems. I started looking for a solution by undertaking some direct sowing trials in 2002. In Summer 2002, eucalypt and *Acacia* were direct sown into 7-L, air-root-pruning containers containing a fine-textured purpose-designed medium. The 7-L, 3-D air-root-pruning container is currently the smallest available size at 20 cm diameter. The pots were spray watered until seedlings had established. A germination success of 90% was achieved. The pots were then flood watered, where the plants were stressed to near wilting point between each flood cycle. The plants were judged ready for sale in 120 to 140 days with calipers of 10-mm and an average height of 1 m. Plants were then harvested and the root systems examined, radicles were straight and even the secondary and tertiary root array was very encouraging. The process is still experimental and needs further validation.

SOLUTIONS?

I would like you to consider a new 3D air-root-pruning propagation system. The idea has emerged from these 2 years of trials.

- The cell (Fig. 1) will be similar to the existing 3D air-root-pruning containers with a range of sizes from 2×2 cm to 5×5 cm, all to fit into 384-mm square. Cells to be deep, square in section, and with vertical walls (tapered pots are 2.5D). More than 20% of the wall

and 20% of the base will be open to air. There will be a 20-mm air gap under the base. The proposal will permit and require high levels of natural air ventilation.

- The growing medium texture will be fine, with high water-holding capacity. The same medium will be used for propagation and growing on. There will be no coarse bark particles.
- High oxygen permeation rates allow use of finer media without loss of growth rate. Lower porosity media are a better match with the landscape and treescape soils at planting time.
- Sets of procedures are to be developed by propagators, matching the cell size options and the genera being propagated.

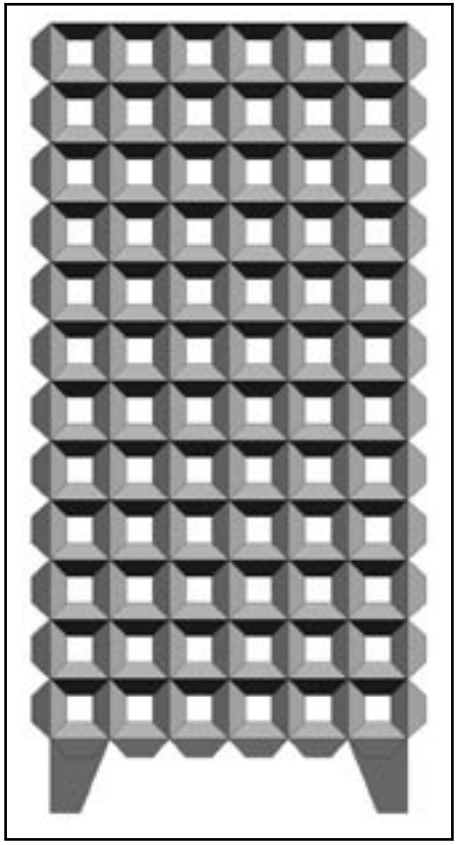

Figure 1. Proposed propagation cell design.

SUMMARY

In advanced tree production 3D air root pruning is well-established but is inhibited by root defects caused during the propagation of the stock. A new 3D air root-pruning propagation system may help to solve these problems.

The proposed system includes:

- A range of container sizes.
- A precisely formulated growing medium.
- Procedures developed by propagators. Perhaps IPPS?

These three elements are inter-linked and each is essential for success.

The new system is not ready yet. It is disclosed here with a request for industry feedback (<peter@trentcom.com.au>).

Acknowledgements. In October 2002 Dr. David Nichols of Debco designed a growing medium for our trials. The customers of Trentcom have contributed in many ways to the success of 3D air root pruning in Australia and China by providing valuable feedback. Contributions from many academic and professional horticulturists over the years are freely acknowledged.

LITERATURE CITED

Whitcomb, C.E. 1998. Plant production in containers. Lacebark Publications, Stillwater, Oklahoma. U.S.A.