Plant Tissue Culture: Future Opportunities©

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ORCHID TISSUE CULTURE — THE PAST

Laboratory propagation of plants was first attempted in 1874 by Noel Barnard for the raising of orchids from seed by using a fungus in the medium. Orchids generally cannot be propagated without a symbiotic fungus. This was probably the first method for the in vitro propagation of any plant. In 1884 Lewis Knudson developed an asymbiotic method of growing orchid seed in vitro.

Tissue culture of many plants was attempted over the following half century, but it was not until 1956 that Georges Morel developed a commercial technique of cloning cymbidium orchids. The technique was quickly adopted by several commercial nurseries and plant tissue culture was established. Orchids were the first plants to be cloned commercially, probably because of the techniques established for growing them from seed and their high market value.

During the 1970s and 1980s there was an explosion of general plant tissue culture laboratories in Australia. Most laboratories grew the same range of carnations, ferns, philodendrons, African violets, syngoniums, roses, kangaroo paws, bulbs, and natives. As far as I can establish, unfortunately none are still in business. This collapse was due to a number of reasons, including price competition which was savage, techniques were not advanced enough to allow diversification, and labour costs were high and the market small. This is, unfortunately, common in new industries.

In the late 1990s a Queensland company, Forbio, tried to reduce labour costs by building robotic micropropagation systems. The idea was great and especially so because it was all Australian. Unfortunately they did not succeed mainly because it was way ahead of its time like the electric cars of 50 years ago. Computerization and robotics at that time meant that the machines were difficult to re-program from doing one plant to doing the next plant and therefore only suitable for very large production runs which were not required in Australia at that time. With today's technology and computers they may have succeeded.

ORCHID TISSUE CULTURE — THE PRESENT

In the 1990s and 2000s the industry rationalised and nearly all laboratories decided to specialize. There are now probably 200–300 commercial laboratories in Australia, each with its own niche market and only a few competitors. This specialization has allowed laboratories to perfect their techniques and obtain larger orders for each clone, thereby reducing costs.

Cost pressure has forced laboratories to look at ways of reducing labour costs. We don't have robots but there are other ways of reducing labour costs. Several years ago my laboratory changed from making the growth medium by hand to using automated media preparators, designed for medical laboratories, to prepare all our media. This has proved to be a great time-saver.

Much of the large-volume work is now contracted out to low-wage, developing countries. Smaller laboratories, mainly in Europe, do the more difficult work of ini-

tiating cultures and then supply multiplying tissue to the contract propagation laboratories, which produce vast numbers of plants which are then distributed worldwide at very low cost. This method is only suitable for high-volume work while the other work is still done by smaller local laboratories. This has caused some difficulties in that a limited range of plants of a genus may be available at low cost from overseas and a wider range locally for a much higher price. In some cost-sensitive areas this has led to a huge reduction in the range of plants available, which is not good for the industry as a whole.

ORCHID TISSUE CULTURE — FUTURE OPPORTUNITIES, A PREDICTION

As techniques improve plant tissue culture will move into more areas of plant propagation, increasing the market for tissue-cultured plants. Tissue culture is not suitable for all applications; it may be too expensive for some plants and just needed to build up initial stock that can then be propagated by conventional methods.

New technology will allow the production of automated machinery that will do smaller runs. This would help local laboratories to cut costs and compete with imports from low-labour-cost countries, and increase exports. Professor Rodney Eaves from the Massachusetts Institute of Technology is leading a team of researchers who are building super inexpensive robots for automation. Instead of very sophisticated and precise mechanical robots which are very expensive, his team is building inexpensive robots, using very sophisticated computers to compensate for their mechanical limitations. These robots will be so cheap that every small business will be able to afford one or more. His prediction is that this technology will halt the exodus of manufacturing from 1st world countries within 10 years.

WHAT INDUSTRY NEEDS TO DO

Tissue culture laboratories need to work with seed propagators because each has an important role in our industry. Plant breeding and growing from seed is vital to produce new plants. Tissue culture should not try to replace all other methods of propagation and instead concentrate on where there is a distinct advantage to do so.

Tissue culture has other uses in the nursery industry apart from general propagation such as providing clean stock plants for conventional propagation. This will maintain the highest possible quality of plants and prevent disease build-up in wholesale nurseries.

Sterile tissue-cultured plants can easily be exported to compete on world markets. Since we cannot compete on price, we need to export our niche plants and exploit areas where we have a technological advantage. One of the main limitations here is Australian red tape, which seems to be hindering exports compared to the situation in the rest of the world. Australian Quarantine Inspection Service strict enforcement of illogical regulations has forced Australia to hand over export work to overseas laboratories when we had a significant technological advantage. We need a level playing field, not one that handicaps Australian business.

Plants can be imported in culture which would be very difficult to obtain otherwise, because of low survival rates in quarantine and high costs involved. Imported stock cultures of plants can be mass-produced in Australia under licence to supply the local market.