WHATEVER HAPPENED TO PLANT TISSUE CULTURE?

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There are, still, many unrealistic expectations that growers bring to tissue culture labs almost every week.

I hope to cover three areas: what we expected of tissue culture, what we thought we were getting, and what we really got.

The 1960's saw a dramatic conquest of the major problems confronting orchid propagation The orchids were slow to propagate vegetatively and were almost universally infected with viruses that caused a dramatic shortening of the shelf life of the flowers. Morel (6) described the methods for producing virus-free *Cymbidium* orchids and how to use tissue culture for clonal propagation of orchids. Scully (10) described clonal propagation of *Phalaenopsis*. Sagawa and Shoji (9) described clonal propagation of *Dendrobiums*. Scully (10) wrote about meristem culture of *Cattleya* orchids.

So here, after decades of steady but slow improvement in vegetative orchid propagation, tissue culture burst on the scene successfully. Where did this put our expectations? Why, we were ripe to hear news of the rosetta stone of propagation.

Now, the 1970's produced literature that made us think that we were getting a complete tissue culture system that was cheap, fast, and would shortly be universally applicable to all plants, (kind of like Eisenhower's 'Atoms for Peace', where nuclear power would be so cheap we wouldn't even have to meter it).

I wish to review some of the early literature to demonstrate where these impressions began. These papers on plant tissue culture "puffed" in three distinct areas.

1) Cost of production.

2) Numbers of plantlets possible (which concurrently implied speed and ease).

3). Plant cultivars that could be propagated.

Anderson (1) has a worksheet showing the cost of producing a plantlet in culture plus the added costs of normal bench handling The tissue culture plantlet costs out to 11.6 cents each. However, then there is a figure shown of 3.8 cents for the costs of establishing this plantlet in soil Lauderdale (3) summarizes a presentation given by Bruce Usrey showing costs for liners in new beds. Using 3 cents each for the cuttings, the final cost was 28 cents each, based on a volume of 12 million cuttings. If Anderson had used his 11.6 cents

lab costs and had taken the data from Lauderdale for the costs for growing on, Anderson's tissue culture plant cost projections would have been 36.6 cents. Thus, growers looking at the tissue culture projections saw a final cost of 15.4 cents compared with 28 to 36 cents for the probable cost. Obviously, many would have been much more pessimistic given an almost 100% discrepancy in these cost projections.

The initial numbers of plantlets projected from tissue culture sounded too good to be true. Murashige (8) suggests that it is premature to claim commercial feasibility without extreme care and followup testing. Murashige lists, however, hundreds of plants under the heading ''Plants with demonstrated potential for clonal multiplication through tissue cultures''. These papers both appeared in the same year.

In a similar vein, Earle and Langhans (2) wrote that ''the amount of sterile manipulation involved may make it unrealistic to use this technique for large scale propagation''.

However, all of these authors immediately make reference to tantalizing large numbers of plants that can be produced by repeated division of multiple plantlets from shoot tips in sterile culture. Earle and Langhans (2) show that chrysanthemum propagation in vitro could lead to over 200 million plantlets per year from a single tip. This is followed by Miller and Murashigi (5) who translate these numbers into multiples, stating that the chrysanthemum procedure is actually an increase of plants 3 million times faster per year.

Not to be outdone, the California Association of Nurserymen in their 1975 research notes take the Earle and Langhans data and state that, (based on an initial data for only 1000 mum plants on the greenhouse bench), this system could in actuality produce 90 billion plants within a year! (This is a number that is *significantly larger* than all of the plants ever vegetatively propagated by human beings!)

Finally, if one examines a current table of contents for '*Plant Cell Reports*' No. 2, 1990, it can be seen plant tissue culture is alive and well, but quite far from the early concepts.

So, from the work with orchids, we expected a complete breakthrough in propagation through tissue culture. From the literature it seemed that we had reached that point. However, what we really got was—using Linsmaier/Skoog salts and modifications thereof—a system that does a good job propagating many herbaceous plants. Additionally, it provides a platform for further development and evolution of tissue culture systems. We didn't get the rosetta stone, but it would have been surprising if we had.

LITERATURE CITED

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