Plant Tissue Culture, Dispelling the Mystique

Brian J. Callaghan
Lifetech Laboratories Limited, P.O.Box 188, Albany, Auckland

INTRODUCTION

I have been involved in commercial propagation of plants using tissue culture techniques since 1981. Over these last 15 years, I have seen a dramatic change in our nursery customers' attitudes towards the use of tissue-cultured plants. The need to produce plants in a cloistered environment of a laboratory decked out like an operating theatre, has made it difficult for the average propagator to relate to tissue culture in a similar way as she/he would when producing plants by traditional cuttings or by seed propagation. Nowadays these techniques are used as an everyday tool to bulk up certain lines. In this paper I will discuss the simple steps in the tissue culture process and try to dispel some of the associated myths.

I intend to use the main crop produced at Lifetech Laboratories as an example of how tissue culture can be applied to commercialise this important crop.

ZANTEDESCHIA - THE CALLA LILY

Although a native of South Africa, *Zantedeschia* hybrids have been bred in New Zealand for over 50 years and today, represent the second largest cut flower crop produced in our country, especially grown for export markets. A large demand exists overseas for high quality, healthy *Zantedeschia* tubers.

The natural, asexual multiplication of this plant will result in tuber offsets giving a two to threefold increase per year. Modern tissue-culture techniques mean we can produce as many as one million identical plants in a year, thus enabling breeders to bulk up quickly stocks of new colours to be released as named cultivars.

Figure 1 shows the basic steps involved in tissue culture propagation.

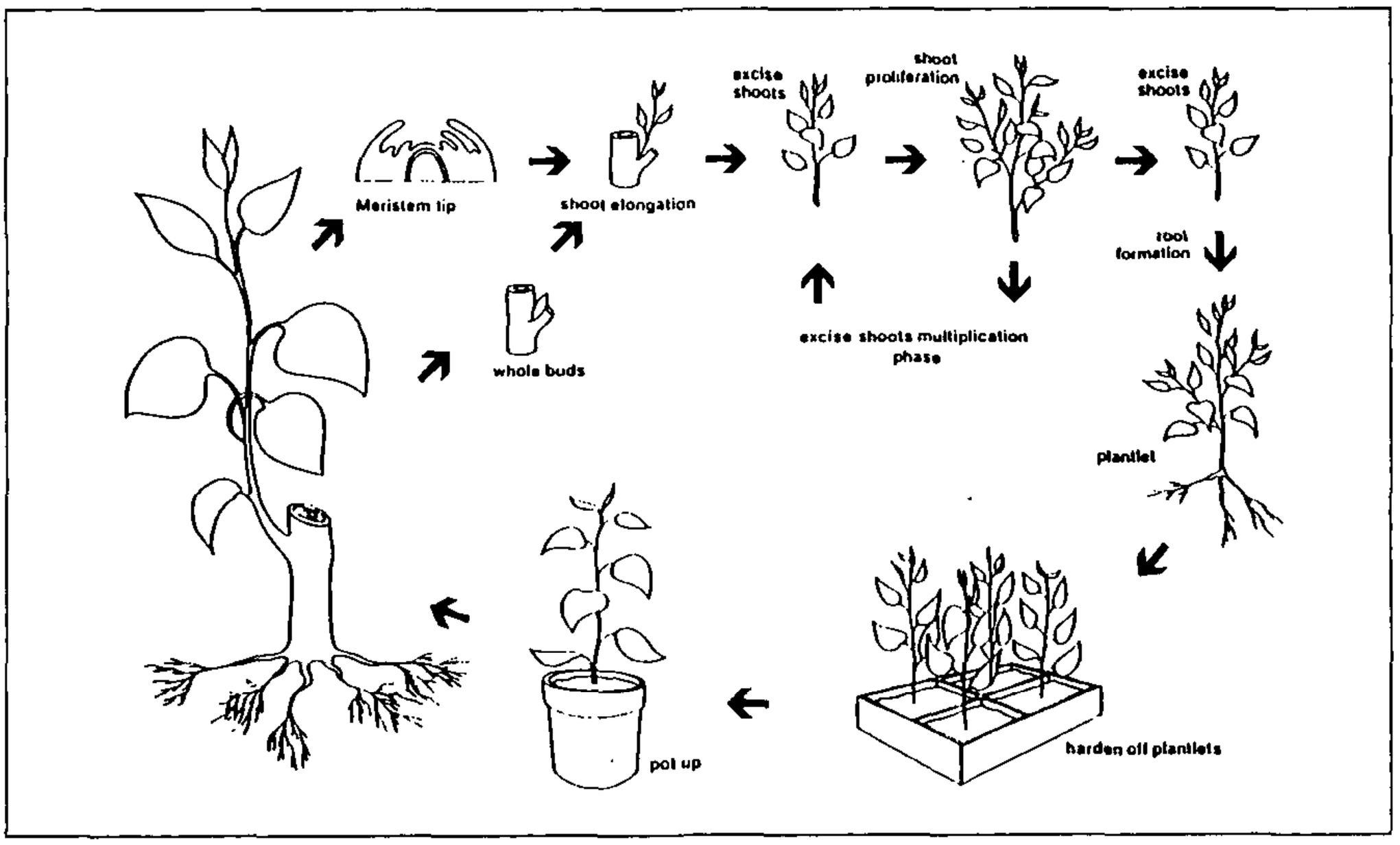

Figure 1. The plant tissue culture process.

There are several clearly defined stages in the process:

Preparation of the Mother Plant. After a rigorous selection from seedlings which show superior characteristics, plants are prepared for the tissue culture process. *Zantedeschia* cultures are initiated from the buds of dormant tubers.

Following virus indexing, the stock plants are subjected to an intense spray programme aimed at eliminating pathogens and other microbes. The new soft growth which is encouraged to emerge under controlled nursery conditions, produces ideal plant material for tissue-culture initiation.

Production of the Growing Medium. There are many different formulations which have been developed for plant tissue-culture propagation. Nutrients in the form of high grade laboratory chemicals are combined in optimum concentrations for plant growth together with a gelling agent such as agar. This medium is then sterilised by heat, usually in an autoclave.

Initiation of the Cultures. Tissue cultures are initiated following the surface sterilisation of excised buds from the tuber. A combination of chlorine (household bleach) and detergents are used to kill all microbes. The *Zantedeschia* tuber taken directly from the ground presents special challenges when attempting to initiate sterile cultures.

Using laminar flow cabinets which provide a sterile air environment, trained operators carry out aseptic procedures to transfer the sterilised buds, called explants, onto the prepared culture medium.

The new cultures are incubated under a controlled temperature and light regime to encourage new growth from the buds.

Culture Multiplication. Following the establishment of sterile cultures, plant hormones, normally cytokinins, are incorporated into the medium to encourage the production of multiple shoots. Commercial multiplication rates are required to justify the expense of using laboratory production. We can achieve rates of 3-4 times every three weeks with the *Zantedeschia*.

Rooting of Plantlets. Once a target quantity of shoots has been produced, rooted plantlets are encouraged by the application of rooting hormones called auxins. For economic reasons, we try to root tissue-cultured plantlets directly into the nursery. However, we root *Zantedeschia* plantlets in vitro, in flasks to enable the easy shipment of large numbers of different cultivars to domestic and international markets.

Nursery Weaning. There have been many changes in nursery technology over the last 15 years. Tissue-cultured plants when taken directly from the laboratory require high humidity and low light, often with bottom heat to enable them to acclimatise and commence photosynthesis. Different nursery methods can achieve this; e.g. using fog, mist, humidity tents, and frost protection cloth.

We have developed a simple yet very effective system of producing *Zantedeschia* tubers directly from tissue-cultured plantlets. A light woven cloth is placed directly onto the plantlets and this is kept in place for about 2 weeks to maintain high humidity. The plants grow quickly in a free-draining soilless potting mix and after about 150 days, natural senescence occurs. The resulting tubers go into dormancy and they are then cleaned, graded, and stored ready for export markets.

SUMMARY

Zantedeschia flower and tuber exports in New Zealand have been able to grow rapidly through the availability of high health clones produced by tissue culture. The technology has been simplified for nurserymen with a wide range of skills and facilities, to grow the latest varieties, enabling them to become part of an expanding export industry