THE FUTURE USE OF MICROPROPAGATION IN THE UNITED KINGDOM

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There is little doubt that the commercial use of micropropagation has been considerably greater in the United States than in the United Kingdom. Only in the propagation of orchids has the technique become widely adopted in this country.

Since the early 1960's the range of plants which can be successfully micropropagated has increased enormously. While much of the initial activity was centred upon flower and pot plant crops, over the last 10 years there has been more effort directed towards woody plants. Commercial enterprises have been established throughout the world to propagate plants by this technique either in specialist laboratories or on existing nurseries.

What are the advantages of micropropagation?

Rapid propagation — Many systems involve the division of plant material every 4 to 6 weeks, producing, at least, a doubling of plant material on each occasion. In most cases this can continue throughout the year. Large numbers of plants can, therefore, be produced relatively quickly from microcuttings or other parts of plants.

New species and cultivars — These can be introduced into commercial production in large numbers and more quickly than might otherwise be the case.

Disease-free stock — Such stock can be propagated rapidly in a system which helps prevent reinfection and be introduced more quickly than might otherwise occur. Often it is mistakenly assumed, however, that micropropagated material is free from pests and disease simply because it has been through a tissue culture system. This is not necessarily so. It is essential to test material to ensure it is of the required health status.

Propagation of difficult-to-root species — Often such plants can be propagated more readily than by conventional means.

Programmed production — Because the propagation process is highly controlled and can be carried out all year round, production can be accurately planned.

High quality — Quality of plants can be high, especially if selected stock plants are used.

Reduced stock plant area — Because of the ability to produce large numbers of plants the area devoted to stock plants can be much reduced.

Plant export and import — The exchange of material between countries is aided if plants are grown under these clean conditions.

Present use of micropropagation in the United Kingdom.

A range of companies are currently involved in the exploitation of the technique in the UK.

Multinationals — These are generally such companies exploring the possibilities of various areas of plant biotechnology. In micropropagation they tend to be interested in tropical crops or forest tree species.

Specialist micropropagation units — These are set up to provide a service utilising these techniques. Until recently these units have been producing only to contract or firm orders and selling a rooted plantlet unweaned. Recently there has been a trend towards producing a weaned plant in modules, and some laboratories are beginning to produce and sell their own plant lines.

Large nursery companies and co-operatives — There are very few in this category who have provided their own facility.

Specialists nurseries — These produce a narrow range of plants, e.g. rhododendron, choice plants with limited sales or propagation difficulties, and those introducing new species or hybrids. Very few nurseries at present are in this category.

It is difficult to give an exact idea of the crops being propagated at present by tissue culture. Generally pot plants and flower crops would be high on the list in terms of volume produced. A considerable number of disease-free plants such as chrysanthemum and potato are being produced. Plant breeders are using the services of micropropagation firms increasingly either to enhance their breeding programme or to propagate new cultivars. At present the only plant from the range of hardy nursery stock to be propagated in any number in culture within the UK is roses.

Further uses of micropropagation in the United Kingdom.

The area of prediction is beset by difficulties but certain trends are already beginning to emerge. Comments will be restricted to uses of the technique on ornamental nursery stock in the main. Significant uses of micropropagation exist in other sectors of horticulture also.

Multinationals will continue on the fringe but some of their work on forest trees will be of interest within horticulture. Some may take a greater interest in the exploitation of the technique through their subsidiary companies.

The specialist units are already tending to extend their activities and specialise in certain areas and crops. Some will emphasize research and biotechnology while others may well become young plant producers competing with traditional cutting producers.

The large horticultural company or co-operative may well be in some difficulty in the use of this technique. This occurs primarily from the wide range of plants which they grow. Without clear objectives a considerable amount of money and effort could be dissipated to no avail.

Specialist nurseries are in a somewhat easier position in evaluating whether micropropagation is a technique which is useful to them.

Plants which will be micropropagated in the future is again difficult to determine. There has been considerable discussion over recent years of the merits of plants which can be sold in high volume against those with propagation difficulties as suitable candidates for this technique. Personally I favour plants which have or may be capable of large volume sales. If a difficulty in conventional propagation exists which can be overcome by micropropagation so much the better.

The first woody crop plant of major significance to be micropropagated is and will continue to be roses. Within 10 years it is not difficult to imagine half the annual output utilising tissue culture techniques in some way. A major shift towards container roses would probably result rather than direct replacement of the budded field-grown crop. Other marketing opportunities may well develop also.

One other major grouping of plants to be micropropagated will, no doubt, be rhododendron and azaleas, principally due to the success of these in North America. Other ericaceous plants will also be tackled using similar techniques.

Worked trees will not be exempt from the influence of the technique. It will be used to propagate selected rootstocks for some tree species and forms and also to produce trees on their own roots. There could well be some discussion as to whether this will be achieved solely by the use of micropropagation or by the use of improved hardwood cutting techniques. I suspect each technique will find a place in commercial production.

There will be an increasing level of use for micropropagation in the rapid introduction of new material whether with

disease resistance, like the elms, or new cultivars or introductions from botanic gardens in the UK. It should also be pointed out that micropropagation will include both woody plants and herbaceous and aquatic plants.

There is sufficient information available from worldwide research to enable commercial systems of propagation to be developed for a wide range of nursery stock (Table 1). The absence of a species does not necessarily imply any inherent difficulty of micropropagation, but is rather an expression of the vast range of species. Many species will, no doubt, respond to the same or similar *in vitro* conditions as some species already successfully investigated. In order to aid the propagation of such species it should prove possible to group plants according to their general response to *in vitro* conditions. At least three such groupings are emerging and will, hopefully, be refined and developed:

a) herbaceous plants — requiring relatively high nutrients

b) woody plants — requiring relatively low major nutrient concentrations

c) conifers — media has not been accurately determined

Table 1. Successful Micropropagation of Hardy Nursery Stock Species.

Acer platanoides; other *Acer* spp.	*Liquidambar styraciflua*
Alnus incana	*Liriodendron tulipifera*
Azalea (see also rhododendron)	*Magnolia* spp.
Betula pendula	*Malus* spp.
Buddleia davidii	*Paulownia tomentosa*
Camellia spp.	*Phlox* spp.
Clematis spp.	*Pinus ponderosa*
Cornus canadensis	*Pinus taeda*
Cupressus arizonica	*Populus* spp.
Crataegus × *mordenensis* 'Toba'	*Potentilla fruticosa*
Cryptomeria japonica	*Orybys* spp.
Daphne odora, *D. burkwoodii*	*Rhododendron* spp.
Delphinium spp.	*Rosa* cvs.
Embothrium coccineum	*Salix* spp.
Eucalyptus spp.	*Schizophragma* spp.
Forsythia spp.	*Skimmia* spp.
Garrya ellipitica	*Spiraea* spp.
Hamamelis spp.	*Tectona grandis*
Hosta spp.	*Thuja plicata*
Hydrangea spp.	*Tsuga heterophylla*
Hypericum spp.	*Ulmus* spp.
Ilex spp.	*Viburnum* spp.
Kalmia spp.	*Weigela* spp.
Laburnum spp.	

Research aimed at the development of this approach would benefit the industry considerably. In conjunction with this more attention should be paid in research to the effects which *in vitro* conditions can have upon the growth and over-

all performance of plants when potted up or lined out in the field.

Information is deficient at present on the transition of plantlets from culture to establishment in compost and their growth to point of sale. It is hoped that ADAS development work and monitoring will be concentrated upon this particular area as resources allow.

CONCLUSIONS

The preceding comments are hopefully optimistic in outlook and emphasise my belief that micropropagation has a significant place within the UK nursery industry. The technique will not solve all problems (new technology never does) but can be usefully exploited to commercial advantage in many situations. Like any technique of propagation it will have to find its place in the same way as mist or chip budding or hardwood cuttings.

Like so much new technology micropropagation is a very good servant but a dangerous master. One of the major limitations to its successful utilisation is the problem of effective management. It is essential that clear objectives are set for its use on a very narrow range of plants. Once successful this firm base can be used to investigate the feasibility of micropropagating other plants.

WEANING AND GROWING-ON OF MICROPROPAGATED PLANTS

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The Concise Oxford Dictionary definition of "to-wean" is — teach to feed otherwise than from the breast — by enforced abstinence or counter attractions.

H.J. Welch in his book, "Mist Propagation and Automatic Watering," discusses the weaning problem thus, "I must confess to being skeptical about there being, in fact, any such thing. Even the term "weaning" seems to be singularly inappropriate, the allusion to an infant being gradually taught to accept solid food instead of milk bearing no real connection with what is happening to the rooted cutting.

To a certain extent I think Welch's skepticism justifiable where more traditional propagation is concerned. But I do see