Managing the Environment for the Production of Quality Plugs

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The essence of plug production is in the ability to control the environment. For plug production to be cost effective maximum outputs must be achieved for each square metre of available greenhouse space. The provision of optimal conditions must be the aim throughout the production process, which can take between 3 and 12 weeks depending upon species grown.

Seed Storage. The process begins by using the highest quality seed which has been stored in a dry conditioned atmosphere between 12 to 15C and 35% to 40% RH. Seed will tolerate fluctuations in temperature, but viability and vigour are greatly reduced with fluctuations in RH, particularly if levels increase.

Sowing. Sowing is done mechanically on either drum or needle seeders depending upon the shape of the seed. Accuracy is the key, not speed, so the control of dust, wind, temperature and light in the sowing area is important. Seeders must always be kept clean and well maintained.

Germination. The highest percent germination will always be achieved under optimal conditions. Ideally chambers should be used which will maintain temperature at +/-1C ranging from 15 to 28C and 80% to 95% RH. If possible incandescent lighting should be used. At Floriana we grow over 360 different cultivars from 60 species, each has its own optimal set of conditions for germination. We have four chambers, each with the flexibility to provide a range of environments.

Germination can be quite rapid so accurate labeling of trolleys, showing actual time and date sown, is crucial in the timing of when to house the trays. Just visible radicle emergence is classed as germination. Hygiene in the chambers is also critical as the warm, humid conditions are ideal for fungal growth.

Growth Stages. All germinated trays are moved into controlled-environment greenhouses, onto wire benches. Control of this environment is not as critical as that for germination, however the better the conditions, the better the results. In some cases microclimates may be needed for special crops that require short-term exposure to higher or lower humidity or light levels. This can be achieved by the use of thermal screens or blankets within the growing house.

Preset growing conditions should be monitored and controlled in the correct sequence so as to achieve optimum growth, as well as to be cost effective. Small computers are ideal for sensing and controlling temperature, humidity, and light levels by operating exhaust fans, heaters, evaporative coolers, and screening as required. Automatic control is most effective as growth is rapid and conditions can be changed easily by re-setting the parameters on the computer—rather than moving the crop to another environment. The aim of this housing stage is to achieve maximum root development with minimal top growth.

Conditioning. The only move necessary after the final growth stage is to a cooler environment for conditioning or hardening off prior to transplanting. Controlling this area is not critical if short-term storage is planned. Cooling is an important consideration and this can be achieved simply by using cold greenhouses, with roll-up sides to maximise air flow and correct shading or screening to allow maximum light levels. Long-term storage of plugs is possible but this requires specialised environmental control.

The conditioning stage is important and should result in a plug that has reached ideal root ball development and foliage that is hard enough to withstand the stresses of transplanting, yet have the vigour to quickly re-establish and grow with minimal setback.

SESSION 4: SPECIALIST PROPAGATION TECHNIQUES

Horticultural Research at the Royal Botanic Gardens

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INTRODUCTION

The Royal Botanic Gardens Melbourne has recently established a formal horticultural research program. The main areas of research are *Phytophthora*, prospecting Proteaceae for the horticultural industry, and the photoautotrophic micropropagation of *Banksia* for the horticultural industry and *Caladenia* for conservation.

PHYTOPHTHORA

The control of *Phytophthora* in cultivated areas is essential to prevent restrictions on the range of plant taxa that can be grown. The Royal Botanic Gardens is currently undertaking a collaborative project with the School of Botany at the University of Melbourne to test the possibility of using antagonistic microorganisms to eliminate *P. cinnamomi* from infected soils. The trial has been running since Sept. 1995, and will continue until May 1997.

PROSPECTING PROTEACEAE

The generic diversity in the Proteaceae of north-eastern Queensland, and New Caledonia, is being looked at for their potential as landscape plants or as new floricultural crops. Research on the optimal propagation methods for taxa showing horticultural potential will follow.

PHOTOAUTOTROPHIC MICROPROPAGATION

Photoautotrophic micropropagation trials are currently being set up for two areas of work;

1) The micropropagation of *Banksia* with the aim of having an asexual propagation technique that will enable superior selections to be made for the cutflower or nursery industries.