PROPAGATION OVERSEAS—AN OVERVIEW

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This paper contains impressions observed in California and in the United Kingdom gained as a result of a Professional Experience Program undertaken in 1986. The primary aim of the program was a teaching exchange with a lecturer from the Merrist Wood Agricultural College in Surrey, England. The Nursery Department of the Merrist Wood College concentrates primarily on the Hardy Ornamental Nursery Stock Industry (H.O.N.S.) and the scope of this paper reflects that specialisation.

THE PROPAGATION ENVIRONMENT

The range of propagation environments I wish to include are: mist propagation; fog propagation; greenhouse tent propagation; sun tunnel propagation.

Mist Propagation Although now regarded as an outdated propagation environment by many propagators, mist propagation was observed in a variety of situations which demonstrate the unique flexibility of the system. In the predictably dry summer climate of southern California, outdoor mist propagation is widely used in nurseries. A variety of control devices are in use but time clocks appeared to be the most common. Outdoor mist propagation is used for around six months of the year from April to September with good results. A wide range of hardy shrubs, ground covers and perennials are propagated during that summer period. Because of the increased risk of desiccation of cuttings propagated outdoors, softwood cuttings are avoided and firmer semi-ripe cuttings selected. It is also common practice in California for mist propagation to be used in shadehouse structures. Similar seasonal limitations apply and softwood cuttings are avoided.

The erratic summer climate of the United Kingdom precludes any use of outdoor mist and all mist propagation is located in fully enclosed greenhouse structures. The high capital cost of greenhouses makes it imperative that the structures are utilised all year round. Greenhouse space heating and bench or bed heating are essential in winter use of mist propagation. Trials carried out at the Efford Experimental Horticulture Station in England suggest that a basal temperature of 18°C is desirable.

The hardy ornamental nursery stock industry is able to utilise mist propagation successfully all year round for a wide range of deciduous and evergreen shrubs with softwood cuttings used in spring and early summer, semi-ripe cuttings through summer and autumn and ripe evergreen cuttings throughout the winter period.

Accurate control of the misting sequence is vital in winter to prevent overwetting of the propagation medium and depression of the temperature of the medium—two problems commonly experienced in the use of mist propagation during the winter in Britain.

Fog Propagation. The relatively coarse droplets produced by impact type mist sprinklers means that the droplets cannot remain suspended in the air for any length of time. They precipitate out onto the cuttings very quickly and this leads to overwetting. As a means of humidity control, mist propagation is rather crude and it is gradually being replaced in many nurseries by fog propagation.

Fogging equipment produces a much smaller droplet (10 to 30 microns) which remains suspended in the air for a considerable time. This provides a propagation atmosphere with a high humidity and reduced risk of overwetting the propagation medium or leaching the foliage of the cuttings.

Three types of fogging equipment are commercially available:

(i) *Ventilated Fog:* A large propeller fan mixes large amounts of air with a water supply which is broken up into fine droplets by a spinning disc and blows the water stream through the greenhouse. No compressor is needed for this system, which makes it the cheapest alternative. The air turbulence also creates an evaporative cooling effect. The principal disadvantage is that a humidity gradient is created; overwatering can occur close to the outlet but the furthest areas of the greenhouse will be substantially less humid.

(ii) *Pressurised Water Fog:* A compressor is used to force water at high pressure (up to 600 p.s.i.) through stainless steel micro-nozzles. This produces the finest droplet size (as small as 10 microns) which will remain suspended in the air for a long period. This is a much more expensive option but provides the best control of the propagation atmosphere.

(iii) *Pressurised Air/Water Fog:* Compressed air and low pressure water are mixed in special sonic nozzles which create a shock wave which results in small fog particles being produced. This system is a compromise option; it is not as expensive as pressurised fog but is more uniform in its effect than ventilated fog.

Work carried out at Efford Experimental Horticulture Station suggests that shading of the greenhouse in summer is essential to reduce greenhouse temperatures since ventilation is not possible. Lining of the inside of the greenhouse with polythene film has been found to reduce the rate of fog dispersion.

Fogging equipment is probably the most sophisticated propagation equipment available but its effectiveness depends largely on

the control of the equipment. Simple time clock control is one option which is used but the plant propagator must be able to observe environmental changes and make alterations to time clock settings as necessary.

A number of humidistats are available which in theory can be set to provide a constant level of humidity. In practice, these devices must also be monitored regularly and adjustments made.

Greenhouse Tent Propagation. Although this would be considered a low technology option in cutting propagation, the use of greenhouse tents is widespread in English nurseries, particularly in winter. The low winter light levels mean that benches which are overwetted remain wet for prolonged periods which can lead to depressed media temperatures and substantial losses through waterlogging and pathogen attack.

Clear plastic sheeting is commonly used and supported above the plants by a wood or pipe framework. The edges of the polythene are usually sealed or tucked in to reduce moisture loss.

Cuttings may be direct stuck in a layer of rooting medium on the bench or they may be planted in trays. Watering is done very sparingly by hand and every care taken to avoid overwatering. It is common practice to periodically remove the plastic cover to ventilate the cuttings and allow some drying to occur to avoid too much free water underneath the plastic. Clear plastic sheeting with a regular pattern of perforations is available and widely used in winter. It allows some drying out to occur and helps to prevent over-wet conditions.

Basal heating is an advantage in the initiation of roots; 15 to 18°C is commonly used as a base temperature. Electric heating cables and warm water pipes were both observed as heating methods.

In a number of establishments the propagation tents were located at floor level in the greenhouse with basal heating incorporated in the greenhouse floor.

Plastic tents are used in many nurseries throughout the year and the late spring-early summer period is a peak season for cutting propagation. Some shading may be necessary with softwood cuttings at that time of year. This can be achieved with white paint or shade-cloth. After rooting, a progressive reduction in shading is desirable to harden off the cuttings prior to removal.

Sun Tunnel Propagation. The sun tunnel is a modification of the traditional cold frame which has been developed in England as a low cost outdoor propagation environment for easy to propagate shrubs and perennials.

The basic structure is a low tunnel frame made from high tensile wire or galvanised pipe covered with a polythene sheet. The dimensions can be adjusted to suit individual requirements but sun tunnels observed in England were commonly 0.75 to 1.2m wide and

0.5m high in the centre of the tunnel.

The sun tunnel can be used as a means of striking cuttings of low shrubs and ground covers directly in the natural soil beneath the tunnel. After rooting, the cuttings are hardened off *in-situ* and the tunnel finally removed. The young plants can then be grown on in the ground until the end of the growing season.

Alternatively, cuttings can be planted in trays and removed for potting after hardening off. If cuttings are direct-planted in the ground, a 3cm layer of propagation medium is spread on top of the natural soil for initial root development. Soil fumigation with Basamid is commonly done to eliminate pathogens from the soil prior to commencement.

For summer propagation of softwood cuttings the incorporation of a mist or irrigation line is essential so that regular watering can be carried out. The use of shading or white polythene film is also recommended in summer.

Winter use of sun tunnel propagation was also observed. A range of easy to propagate evergreen shrubs can be raised from ripe evergreen cuttings planted in autumn. For winter propagation it is recommended that cuttings be planted in the soil rather than in trays. White plastic sheeting is used but the incorporation of an irrigation line is not necessary. Cuttings are thoroughly watered-in after insertion, a routine fungicide spray applied, and the tunnel sealed up until spring.

Where the sun tunnel is used to propagate fast-growing, easy-to-root shrubs and perennials a high degree of success can be achieved. Plants which are considered difficult to propagate should be propagated in a more controllable propagation environment such as greenhouse mist or fog.

DIRECT STICKING OF CUTTINGS

In the propagation of cuttings in England, the normal pattern of production occurs in three stages:

(i) Root development in propagation container;

(ii) Growing-on rooted cuttings in liner pots;

(iii) Growing-on in final sales container.

In recent years the practice of propagation direct in a 7cm or 9cm liner pot has developed. A peat-based rooting medium with controlled release fertiliser incorporated is used. The "EMPOT" tray system is widely used as a unitised system for liner production. Cuttings are direct stuck in the liner pots and the cuttings rooted under mist, fog, or tent.

Direct-stuck cuttings enable the faster growing lines to be produced to a saleable size in a much shorter time than by conventional

methods, a 50% reduction in production time being achieved with many plant types.

The trade-off for faster production using direct sticking is an increased propagation space requirement. To maximise production output in the propagation stage it is not advisable to use this technique with species that have a low success rate.