Design of a Propagation Unit That Independently Controls Atmospheric and Medium Moisture

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INTRODUCTION

Micropropagation consists of four stages that include establishment, multiplication, rooting, and acclimatization. Acclimatization involves the shift from a heterotrophic (sugar-requiring) to an autotrophic (free-living) condition and the acclimatization of the microplant to the outdoor environment (Hartmann et al., 2002). It requires that the propagule be slowly moved from a condition of low light and high humidity to ambient greenhouse conditions. Plant loss during the acclimatization phase can be a serious impediment to commercial micropropagation of some crops (Preece and Sutter, 1991).

The three key factors for optimal acclimatization are relative humidity, temperature, and irradiance (Isutsa et al., 1994). The objective of this experiment was to control atmospheric moisture independent of medium moisture in order to study their relative importance during the acclimatization process. This was attempted using controlled-water-tables in constructed Plexiglas growth chambers. The basic design uses a controlled water table irrigation system (Buxton and Jia, 1997). The system utilizes capillary mats, which draws water from a trough up and across a bench top surface. A 100% cotton material (muslin) or thicker woven 100% cotton was used as the top of the chambers to provide high humidity (Zhang and Stoltz, 1989).

MATERIALS AND METHODS

Two-foot square chambers were constructed using Plexiglas and fitted with controlled water tables (Fig. 1). The water tables were adjusted by raising and lowering the float valves at 1-cm intervals. The top of the chambers contained either constantly wet fabric or solid Plexiglas lid. Fabrics evaluated were either muslin or woven cotton.

The temperature and relative humidity was recorded at 1-h intervals. Data was collected utilizing a computer and a data logger program and presented as daily means.

A preliminary study evaluated rooting of eastern redbud (*Cercis canadensis*) microcuttings. Seedling explants were treated in vitro with 100 µM IBA for 15 days before being moved to theacclimatization chambers. The chambers had no fabric top and the water table set level with the bench. Light irradiance was ~40 µmol $sec^{-1}\cdot m^{-2}$.

RESULTS AND DISCUSSION

Using the capillary mat watering system installed within an enclosed propagation chamber increased relative humidity by approximately 50% compared to the external room (Table 1). There was also a difference in humidity due to the type of material used for the top (Table 1). The chamber with muslin cloth averaged a

Table 1. Relative humidity in propagation chambers using capillary mat subirrigation and fabric top material.

	Relative humidity (%)		
External	No top	Top using muslin	Top using woven cotton
37.5	55.2	85.5	89.8

relative humidity of 85% in comparison to 90% maintained by the woven cotton.

Moving the perched water table in the capillary mat reservoir 4 to 6 cm below the level of the bench reduced the amount of water in Oasis blocks on the capillary mat by 12% to 25% regardless of the relative humidity in the propagation chamber. Reducing the water potential in the capillary mat had no effect on relative humidity in chambers with a moist fabric top. However, reduced moisture in the capillary mat reduced relative humidity in chamber without a fabric top (Table 2).

In a preliminary study using redbud microcuttings, rooting percentage and number of roots per rooted cutting suggest that chambers provide an adequate environment for cutting survival (Table 3). In future studies, these chambers will permit the evaluation of acclimatization in microcuttings by independently changing atmospheric and medium moisture to determine the relative importance of each on the growth of microcuttings following acclimatization.

Table 2. Impact of available water in the capillary mat subirrigation system on relative humidity within propagation chambers with or without muslin fabric top.

Water table (cm below bench)	Humidity with fabric top	Humidity without fabric top
0	91.5 ± 0.2[z]	88.6 ± 1.3
2	89.9 ± 1.7	89.0 ± 1.1
4	90.1 ± 0.2	83.4 ± 1.2
6	90.7 ± 0.4	82.7 ± 1.1
8	89.9 ± 0.4	82.1 ± 1.5

[z] 95% confidence interval

Table 3. Root formation in eastern redbud (*Cercis canadensis*) microcuttings in propagation chambers.

Treatment Water table (0 cm)	Rooting (%)	Roots per rooted cutting (no.)
No fabric top	77 %	7.9

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Efficacy of Five Pre-emergence Herbicides in Pot-in-Pot Tree Production©

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INTRODUCTION

Interest and installation of pot-in-pot systems for production of trees and shrubs continues to grow throughout the nation (Mathers, 2000). Pot-in-pot systems offer numerous benefits for production nurseries and retail outlets including improved root growth during the hot summer months, elimination of tree blow-over, reduced need for overwintering structures, reduced water usage, less impact on field soil and loss of organic matter, and year-round harvest potential (Fidler, 1999). Year-round harvest also means a potential for increased weed management requirements. Traditionally, weed control in field production nurseries employ mechanical cultivation in combination with pre-emergence and postemergence herbicide applications. Similarly, container production nurseries employ a variety of techniques to maintain weed-free growing areas including well-drained gravel, concrete or geotextile covered surfaces, soilless growing media for nursery stock, pre-emergence herbicides, and dormant overwintering conditions to manage weed growth and development (Derr et. al., 1997). The hybrid nature of pot-in-pot production employs characteristics of both field and container growing techniques and environments providing increased opportunity for weed establishment. In order to examine weed control options and to develop weed control management strategies for a variety of trees, this preliminary study was initiated to determine the efficacy of five pre-emergence herbicides for managing weeds in a pot-in-pot system.

METHODS AND MATERIALS

A 400-container pot-in-pot nursery, consisting of four blocks with five 110 ft long rows each containing twenty #20 grip-lip poly containers (Nursery Supplies, Inc.,