VAPOR PRESSURE DEFICIT AND POLYETHYLENE IN PLANT PROPAGATION[1]

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INTRODUCTION

Over the last 30 years propagators have successfully used mist to control water loss from cuttings during the period of root regeneration. There are many excellent references on the subject (5, 6, 8, 9, 13). Emphasis has been on the use of mist to cool the leaves of the cuttings. This results in lowering the vapor pressure within the cutting, thus reducing the vapor pressure deficit (VPD) between the leaf and the ambient atmosphere which, in turn, reduces loss of moisture by transpiration. However, another method of reducing the VPD is to increase the relative humidity of the ambient atmosphere. At a relative humidity of 100%, the VPD (mmHg) at any temperature is zero. Humidity control received some attention by propagators (1, 3, 7, 10) over the years, but most propagators have relied on mist.

Since 1953 many propagators have utilized polyethylene film in plant propagation. Coggeshall (2) propagated difficult-to-root plants in a plastic case. Warner (12), Van Hoff (11) and others have used and discussed the advantages of polyethylene film in the propagation of cuttings.

MATERIALS & METHODS

The purpose of this study was to determine if maintaining a high relative humidity around the cuttings was as good as or better than intermittent misting. Six propagation chambers, 4 ft square and 3 ft tall were constructed within a greenhouse by slightly modifying the design of a conduit polyhouse (4).

Two chambers and an open mist area were constructed on each of three benches. Clear and milky, four-mil, polyethylene sheeting was stretched over separate chambers and stapled to the wooden frames on three sides. One side remained unstapled for ease of entry. But this was closed and sealed with an easily removable lath strip after the cuttings were stuck.

An intermittent mist system was constructed to service the three open bench areas plus one clear and one milky poly unit. An atomized mist system was developed for two of the chambers,

[1] Paper No. 6636 Michigan State University Agricultural Experiment Station. East Lansing Michigan.

one clear and one milky unit. Two 1/4 JH pneumatic atomizing nozzles were used, one per unit. The air supply line contained a pressure regulator, a solenoid valve and a line strainer. An air pressure of 10 psi was maintained. Two 500-liter plastic bottles served as reservoirs to supply water to the system. Both systems operated daily from 7:30 a.m. to 5:00 p.m. The atomizing unit was continuous and the intermittent mist was on for 2.5 sec. every 5 min. The two remaining chambers were misted daily with a Fogg-it nozzle.

The rooting medium consisted of a 1:1 mixture of sphagnum peatmoss and sharp sand. Four species were used in the experiment: boxwood [*Buxus sempervirens*], forsythia [*Forsythia* x *intermedia*], firethorn [*Pyracantha coccinnia* 'Lalandei'] and weigela [*Weigela florida*]. Semi-hardwood, tip cuttings were prepared, dipped in a 15% captan solution and then the basal 1/2" portion was treated with 8000 ppm of IBA. Three replicates of 20 cuttings per species were stuck in random rows in each of the 9 propagatin units, during the evening of October 14 and 15.

Three hygrothermographs recorded air temperature and relative humidity within the polyhouses and in the open mist beds. At weekly intervals the instruments were moved to previously unrecorded plots.

Root quality index values were obtained for each replicate. Forsythia, firethorn and weigela were well-rooted and rated on November 17 and boxwood on December 29. Individual cuttings were graded on the basis of 5 for heaviest rooting, 3 for medium and 1 for light. The data were then analyzed for statistical significance employing orthogonal comparisons.

RESULTS

Relative humidity of the polychambers was maintained close to 100%. The relative humidity of the open mist areas fluctuated considerably from 100% during the day when the system was on, to a low of 42% at night when the mist was off.

All the polychambers had temperatures higher than the open mist beds; temperatures in the clear polychambers were higher than those in the milky chambers. But chambers with mist were cooler than those without mist. The highest termperatures were recorded shortly after noon on sunny days. The temperature of the rooting media did not vary substantially among plots, averaging $67^{0} \pm 2^{0}$ F, both during the day and the night.

All cuttings rooted extremely well in the clear-polyhouse with atomized mist (Table 1). The cuttings remained turgid and free of any visible surface deposit; whereas, the cuttings in the intermittent mist became coated with a white mineral deposit within a few weeks.

Table 1. Average root index values for selected semi-hardwood cuttings rooted in various environments.

Plot	Mist System	Average Index Values Boxwood	Forsythia	Pyracantha	Weigela
Clear Poly	Atomizing	84.7	96.0	94.0	91.3
	Intermittent	.81.3	93.0	76.0	85.7
	Manual	68.7	88.3	77.3	82.3
Milky Poly	Atomizing	65.3	81.7	41.3	64.3
	Intermittent	60.0	85.0	51.3	51.0
	Manual	51.3	.86.3	35.3	44.7
Open Bed	Intermittent	56.9	.61.2	57.0	68.2

When the data were analyzed employing orthogonal, comparisons (Table 2), it was found that cuttings of boxwood, forsythia and firethorn rooted significantly better in the polyhouses with mist than in the open mist beds. But the weigela data did not show significant difference. However, cuttings in the clear polychambers rooted significantly better than those in the milky houses except for the forsythia which rooted equally well in all polychambers.

Table 2. Orthogonal comparisons of selected environments for propagation of cuttings.

Comparison	Significant Rooting Boxwood	Forsythia	Pyracantha	Weigela
Poly + Mist vs. Open + Mist	X	XX	X	—
Clear Poly vs. Milky Poly	XX	—	XX	XX
Clear Poly + At. Mist vs. Clear Poly + Int. Mist	—	—	X	—
Milky Poly + At. Mist vs. Milky Poly + Int. Mist	—	—	—	X

X = significant difference at the 5% level
XX = significant difference at the 1% level

Both misting systems proved to be successful in maintaining a high relative humidity within the chambers. Cuttings of all species rooted well, although cuttings of firethorn rooted better in the atomized mist-clear-polychamber than in the intermittent mist-clear-polychamber.

It appears from these results that maintaining a high humidity around cuttings to produce a low (close to zero) VPD is a significant factor in maintaining cuttings in a vigorous condition during root regeneration. This was best accomplished in this experiment by use of a clear-polychamber equipped with atomizing nozzles. Although cuttings rooted well in the clear house equipped with an intermittent mist system; they did not have as good an overall appearance as did the cuttings rooted under atomized mist.

Since this experiment was done in the fall, the results may not be fully applicable in summer, under high intensity sunlight. It may be that a milky polychamber would be best for that time of year.

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LARRY CARVILLE: I assume the temperatures you gave are air temperatures; did you use any bottom heat and what was your shade factor under the milky poly which you used?

J. SLEZINSKY: We used no bottom heat, the temperatures were air temperatures, and we made no light measurements under the plastic so I can't tell you what the shade factor was.

RICHARD BOSLEY: You mentioned noticing mineral deposits on the leaves of cuttings under intermittent mist; did you analyze the water?

J SLEZINSKY: No, we did not. The water is that supplied by the University and I do know that it is high in calcium.

PRESIDENT TUKEY: Thank you Jim; we will have to hold the rest of the questions for the Pot Pourri.

Our next talk is about low cost propagating structures and will be presented by Carl Orndorff.

LOW COST PERMANENT PROPAGATING STRUCTURES

CARL ORNDORFF

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This is not an experimental project, but the reporting of the changes and upgrading of our propagating facilities over a 15 yr period at the Kalmia Farms Nursery at Clarksville, Md.

Low cost does not mean only construction costs, but also general maintenance costs, operating costs such as heating fuel and general labor operating costs.

Our firm operates a 328 acre wholesale nursery, growing mostly winter hardy woody plant materials in medium and large sizes. We cater to the landscape contracting business in the Mid-Atlantic area, with 90% of our business in a 50 mile radius that covers the Washington and Baltimore markets.

Our firm was originally in a rural area, in what is now the suburban Maryland-Metropolitan Washington area. During the late 1950 period, we moved to the rural area 20 miles west of Baltimore and 25 miles north of Washington. Again Washington and also Baltimore are moving in on us very fast.

In the late 1950 period, we had to start a new propagating facility at our new location. We had on hand one new 52 x 23 ft conventional "A" frame glass house. This we erected as a starter