FOG PROPAGATION — AN UPDATE

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Early attempts at high humidity propagation involved the natural humidification of enclosed chambers which contained the cuttings to be rooted (1). High temperatures during sunny weather and inadequate means of temperature control were frequent reasons for propagation failure (1). The concept of high humidity propagation was advanced during the 1940's by V.T. Stoutemyer of the U.S Plant Introduction Garden at Glenn Dale, Maryland. He supplemented natural humidity with mechanically-produced fog to minimize the effects of solar heating which lowered the humidity during the day. Because high humidity required frequent care by trained personnel and often produced unpredictable results, intermittent mist surpassed high humidity for commercial propagation use. Research was begun in 1974 to solve the problems of high humidity propagation and thus improve it for commercial use. After 4 years of work, the modern concept of ventilated high humidity propagation was developed. This concept solved many of the original problems of high humidity propagation but existing humidification equipment was inadequate for commercial propagation.

Tobacco humidification equipment (Agritech, Inc., Raleigh, NC) was modified to emit a centrifugally-produced fog and it became an acceptable propagating system (2). Since that initial introduction, two additional types of humidification equipment have been introduced: high pressure and vortex-produced fog systems. In the relatively short period of 11 years, ventilated high humidity propagation has been conceived, tested, introduced and accepted as a commercially viable alternative to intermittent mist for propagation.

The ventilated high humidity concept of propagation provides a convenient means of controlling temperatures during propagation. Humid air around the cuttings prevents evaporative cooling which promotes solar heating of the propagation medium. Excess solar heat is removed through the air surrounding the cuttings. Forced air circulating among the cuttings and exhausting of heated air from the greenhouse have made this a very effective means of regulating the air temperature around the cuttings. When this means of temperature control is exceeded by summer heat, shading of the greenhouse is implemented.

The smaller droplet size produced by humidifiers as compared to mist reduces the amount of water applied to the propagation medium. Improved temperature control and saturation of the propagation medium are features of ventilated high humidity propagation that have added to its appeal for propagating plants. Other advantages of ventilated high humidity propagation that increase its feasibility for commercial propagation are its portability and easy adaptation to the popular plastic film-covered quonset-style greenhouse.

Two of the four manufacturers of humidification equipment produce humidifiers that are reasonably light and relatively easily removed from one greenhouse to another. One (Agritech, Inc.) is suspended from a support frame or from the greenhouse superstructure while the other (Humidifan) pivots within its own frame. The remaining two humidification systems (Mee Industries and Atomizing Systems, Inc.) are stationary, much like the intermittent mist systems.

The advantage of mobility is that it permits nursery growers to propagate in any available greenhouse or to use the humidifers for other purposes. The use of ground level propagation and the suitability of quonset enclosures further increase the versatility of an otherwise quite rigorously defined nursery operaton.

Water immersion of cuttings.

In addition to being a commercially acceptable means of propagation, ventilated high humidity propagation has become valuable for research. Because cuttings can be maintained in a healthy condition for longer periods of time, smaller differences due to treatments can be measured with less variation. Because of this, a treatment designed as a control in an immersion pretreatment experiment produced unexpected results. In an experiment in which water was used as a solvent for chemicals, water alone produced earlier root initiation when compared with non-immersed cuttings. The significance of this phenomenon was first studied with poinsettia (*Euphorbia pulcherrima*) cuttings and later with a honeysuckle (*Lonicera xylostoides*) 'Clavey's Dwarf'), rose (*Rosa multiflora*) and Heller's holly (*Ilex crenata* 'Helleri').

Eighty, 6-in. terminal cuttings of field-grown poinsettia stock plants were immersed in 5, 25 and 35°C water for 0, 3, 6 and 12 hours and the 5 cuttings of each treatment were stuck individually in one-gallon containers with a coarse sand medium. Each container was placed in a greenhouse humified with Agritech humidifiers. After 3½ weeks, each cutting was evaluated for root initiation.

Poinsettia cuttings immersed in water for 3 hours initiated roots earlier than cuttings that had not been immersed or which had been immersed for longer periods of time (Figure 1). Because of early root initiation, these cuttings produced more and longer roots in the same period of time required for the remaining cuttings to begin root initiation.

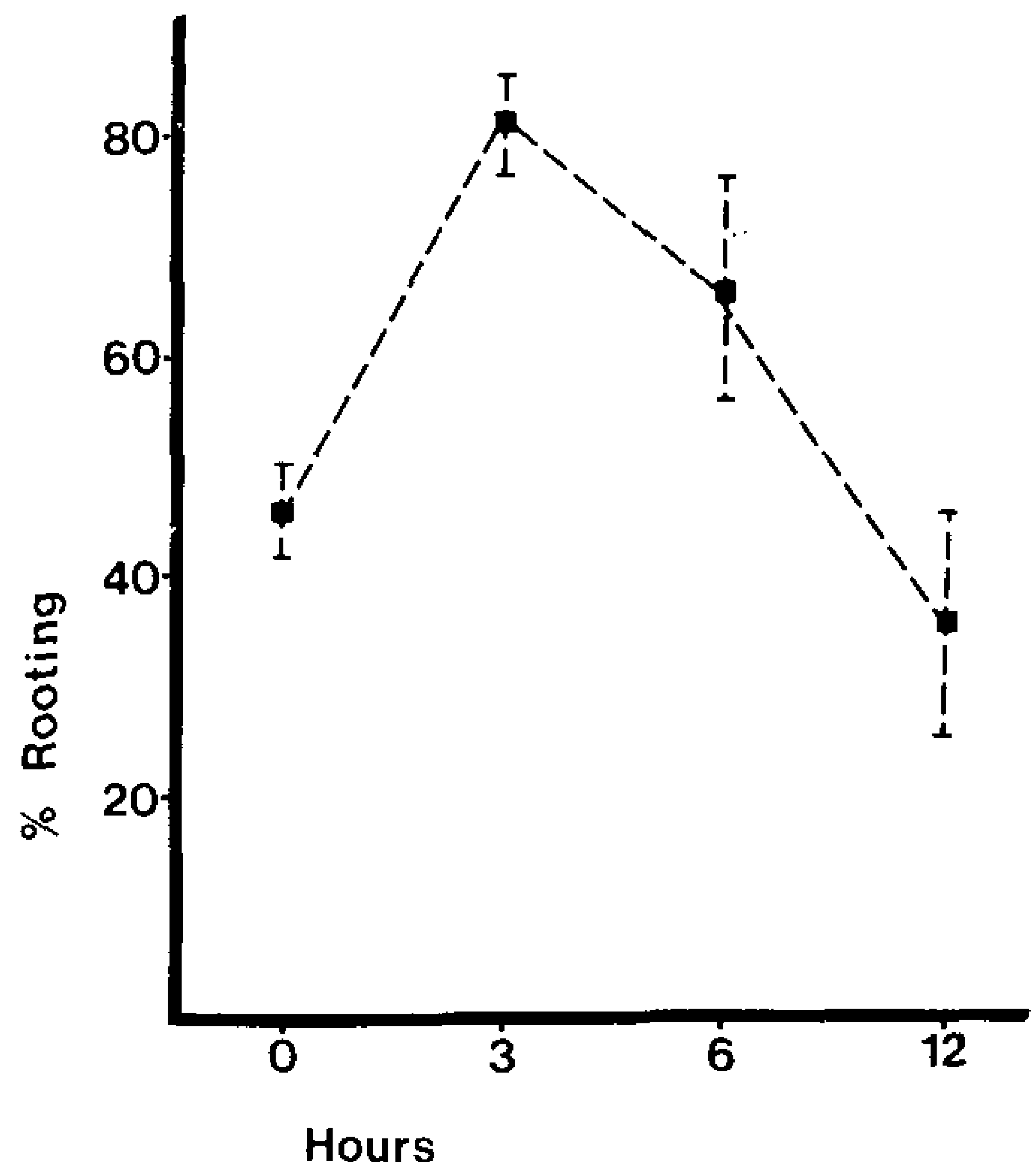

Figure 1. The percent of poinsettia cuttings which rooted after immersion in water for varying lengths of time and propagation for 3½ weeks.

The temperature of the immersion water was also observed to be important. Figure 2 shows that 80% of the cuttings rooted early when immersed in room temperature (15°C) water as compared to 70% when immersed in cooler (5°C) water and 55% when immersed in warmer (25°C) water. When this research was applied to other species the results were variable.

One year later, the effect of water immersion on root initiation was retested using 20 cuttings each of poinsettia, honeysuckle, rose, and holly. Ten cuttings of each species were immersed for 0 and 3 hrs. in room temperature tap water (approximately 20°C) and treated as previously described but in a paired comparison.

After 3 weeks, cuttings were evaluated for root initiation and number of roots. A cutting in a pair was considered superior if it was rooted, when both were rooted, if it had a total root length greater than its companion (Figure 3). All the immersed cuttings of honeysuckle were superior to non-immersed cuttings and 70% of poinsettia and rose cuttings were superior. Holly required an extra week of propagation time to produce similar results. When the experiment was repeated using poinsettia, honeysuckle, rose, holly, and 'Blue Rug' juniper (*Juniperus horizontalis* 'Blue Rug'), holly and juniper failed to produce better rooting as a result of immersion.

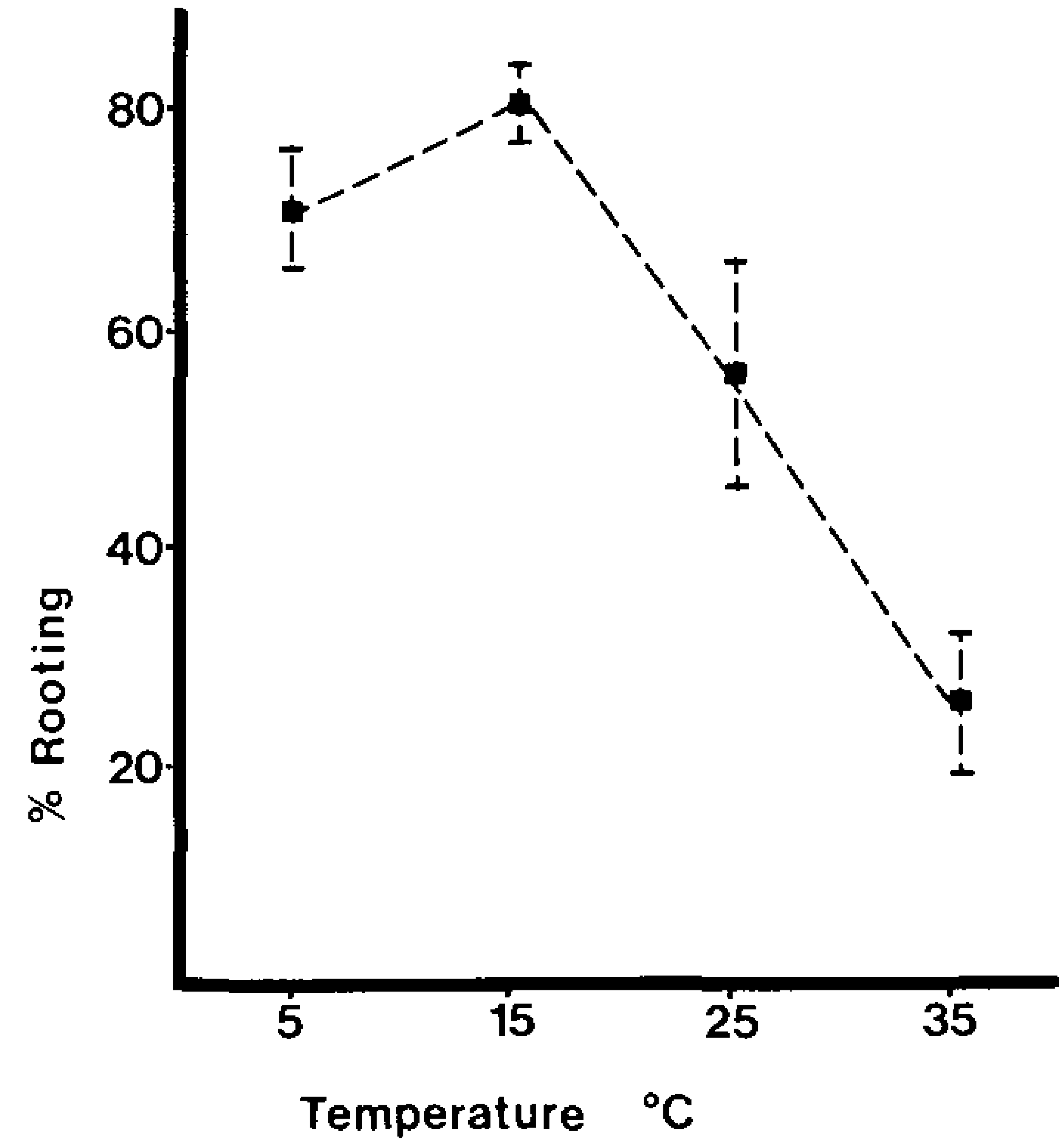

Figure 2. The percent of poinsettia cuttings which rooted after immersion in water at 4 temperatures and propagated for 3½ weeks.

Figure 3. The percentage of superior-rooted members of ten immersion (3 hr.) (solid bars) vs. non-immersion (cross-hatched bars) pairings.

These results show that early root initiation from immersion in water is a reproducible result for poinsettia, honeysuckle, and rose. The variable response of holly and nonresponse of juniper indicate that all the conditions for a favorable response may not be understood or that some species may be unresponsive.

Ventilated high humidity propagation appears to have promising commercial applications for propagation, and immersion, at least for some species, may be a beneficial pretreatment for early rooting of cuttings.

LITERATURE CITED

1. Stoutemeyer, V. T. 1942. Humidification and the rooting of greenwood cuttings of difficult plants. *Proc. Amer. Soc. Hort. Sci.* 40:301-304.
2. Milbocker, D. C. and R. Wilson. 1979. Temperature control during high humidity propagation. *Jour. Amer. Soc. Hort. Sci.* 104:123-126.

RICHARD WOLFF: Just a comment on Dr. Milbocker's paper. We took cuttings of Japanese red maple this past year from plants that were well hydrated from irrigation. Those cuttings rooted 100% as usual. We also took cuttings from our tree farm. We had a drought this past summer and did not hydrate the cuttings from the tree farm and the percentage fell back to 50%. We came to the conclusion that the hydrated trees gave us better rooting.

IMPROVING MEDIA AERATION IN LINER AND CONTAINER PRODUCTION

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Considerable information has been published regarding container media ingredients, their properties and their effects on root growth (1,2,3,4,6). Most modern day propagators use a soilless medium during propagation and/or for subsequent growing on in containers. Every medium has different physical and chemical properties that will affect rooting, and subsequent plant growth and development. In addition, a medium that may be best (poorest) for rooting may be the poorest (best) for growing on in larger containers (5). Consequently, finding a