High Light with Moderated Temperatures Aids the Rooting of Softwood Cuttings

Carl E. Whitcomb
Lacebark Inc., Publications and Research, P.O. Box 2383, Stillwater, Oklahoma 74076

INTRODUCTION

The optimum environment for rooting softwood cuttings in late spring and summer is to have high light intensity combined with moderate temperature and very high humidity — maintained by frequent and light intermittent misting. Softwood cuttings harvested from plants produced under full sun conditions quickly show stress when light intensity is greatly reduced or temperatures become excessively high causing a drop in humidity and dehydration of soft tissues.

THE CHALLENGE

The practical approach for propagating softwood cuttings has been to provide shade to reduce heat and dehydration. I have experienced a few years when that rooting softwood cuttings was not plagued by high temperatures and the need for shade — or at least less shading was required in those years versus when temperatures were high. During seasons of moderate temperature, softwood cuttings typically dropped fewer leaves, rooted faster, and more easily made the transition from mist environment to full sun conditions. Shifting up to larger containers was accomplished with less stress and plants grew faster following transplanting. On a few rare occasions, softwood cuttings rooted so quickly and with so little stress that the terminal bud never ceased growing. The result was a new tree with vigorous growth, straight stem, and little requirement for staking or pruning. By contrast, when propagation temperatures were high, fewer cuttings rooted, more leaves abscised, and the transition from mist bed to shifting up to larger containers caused more leaf drop and sun scorch; plants made only limited top growth for the rest of the season. The question repeatedly became one of how to consistently reduce temperature during propagation without reducing light intensity.

A NEW APPROACH

When the first greenhouse was built at the new research farm in 1996, I oriented the structure east-west. This was the same orientation as the structure in which I had been conducting research on the old site and which had served as the basis for my experiences and observations for the previous 9 years. The new greenhouse was made of 2-inch square tubing with no internal supports and covered with polygal polycarbonate sheeting and no shade.

A propagation bench 1.2 m (4 ft) wide by 9.8 m (32 ft) long was constructed against the south wall. A frame made of 1-inch PVC schedule 40 was suspended over the propagation bench to support a single layer of clear 6-mil polyethylene, thereby creating a plastic tent. The mist line was also made of 2.5 cm (1 inch) schedule 40 PVC with flora mist foggers spaced every 76 cm (30 inches). The mist line was suspended from the PVC frame that supports the poly. Inside the poly tent a 30-cm-diameter (12 inch) poly tube was suspended above the mist line so as not to interfere with the mist distribution and against the under surface of the top of the poly tent (Fig. 1). The greenhouse was cooled only by natural convection aided by roof discharge vents and side inlet vents.

For 1996 the 30-cm (12 inch) unpunched poly tube was attached to a 30-cm (12 inch) fan jet that took in air from outside the greenhouse. The air passed through the propagation chamber and discharged outside the greenhouse at the opposite end.

The idea was to see if, by passing cooler outside air through the poly tube in the top of the plastic tent, the air temperature in the propagation environment would be lowered. For the technique to work, heat that accumulated at the top of the poly tent would have to move through the wall of the poly tube and be removed by the flow of cooler air. A total of 22 readings were taken during June and July with the fan on or off and over a period of 9 sunny days when the outside temperature exceeded 32C (90 F). Temperatures inside the propagation environment and above the mist area were consistently reduced 3 to 4 C (5 to 7 F) with the fan on compared to fan off.

Since some moderation of temperature was obtained, the fan jet was connected to a thermostat with remote bulb sensor suspended approximately 30 cm (12 inches) above the mist line. The thermostat was set to come on when the temperature inside the rooting chamber and above the mist line reached about 33C (92F) and remain on until the temperature dropped below that set point. On days with intermittent cloud cover, the fan would turn on and off repeatedly with the change in heat load. On cooler days, and earlier or later in the day the fan jet would turn on automatically, run for 5 min or more, then turn off even though the light intensity had not changed. This was further confirmation that heat was being removed from the propagation chamber by the poly tube, but without disturbing the air or humidity inside.

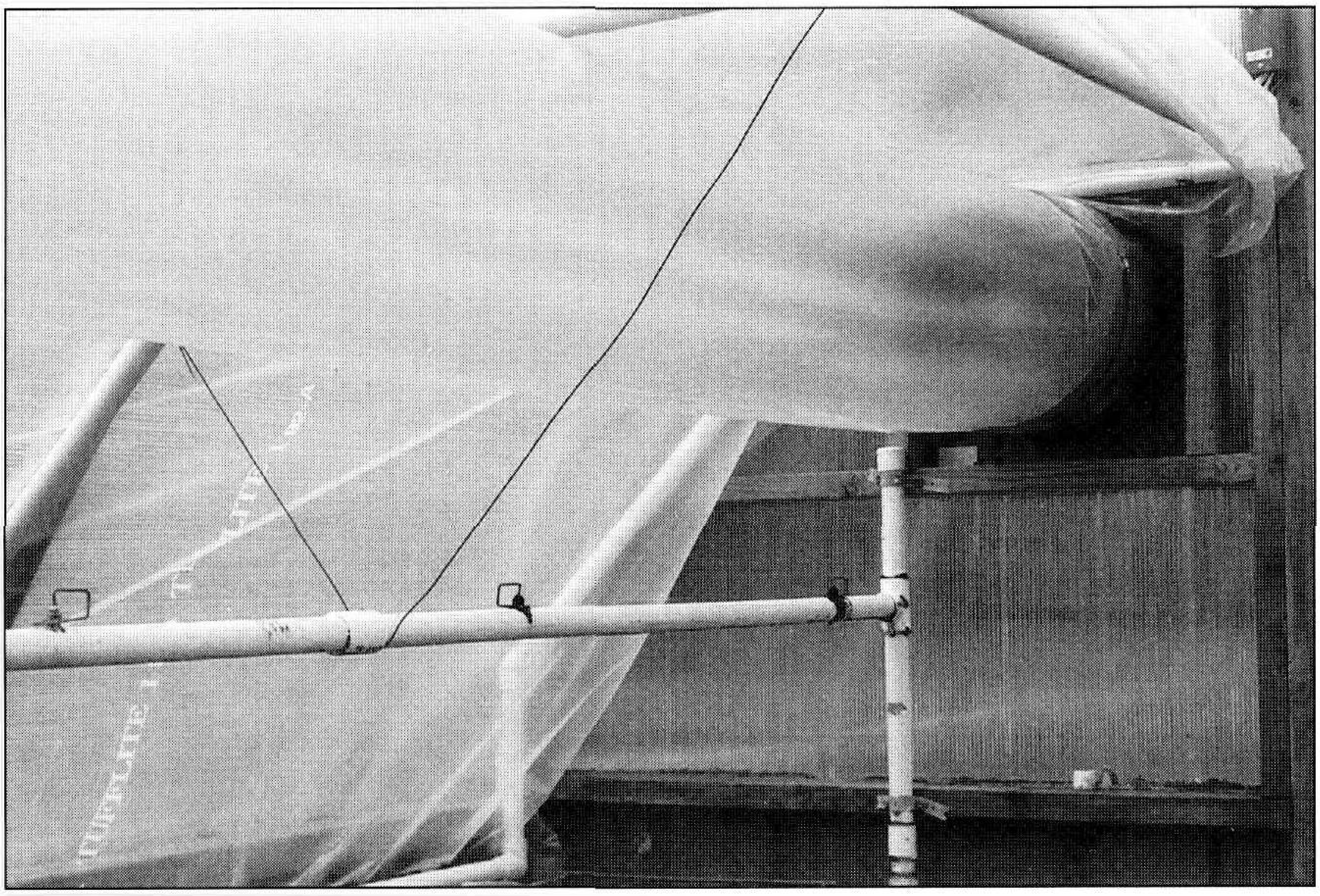

Figure 1. The unpunched poly tube was positioned at the top of the poly tent where heat accumulates and is high enough to not interfere with mist distribution. The poly sheet that encloses the front of the mist chamber has been lifted to expose the positioning inside the propagation chamber.

APPROACH MODIFIED FURTHER

The system was further modified during the 1997 season for propagating softwood cuttings. The fan jet was replaced with a window type evaporative cooler. My reasoning was that if the temperature of the air moving through the poly tube could be lowered several degrees below ambient, that the transfer of heat through the wall of the poly tube would increase further due to the greater temperature differential. A thermostat turned on the evaporative cooler-with-blower when the temperature inside the poly tent reached 33C (92F). Readings were taken during the series of clear days with ambient air temperatures of 33 to 35C (92 to 95F).

REDUCED AIR TEMPERATURE AND GREATER HUMIDITY

A decrease in temperature inside the poly tent of 5 to 6C (10 to 12F) was observed using the evaporative cooler. When the cool air flow was turned off the humidity was 86% to 90% in the air space immediately above the cuttings. With the cool air flow on, humidity ranged from 92% to 98%.

SUCCESS IN ROOTING

Using this technique I was able to root for the first time a seedling redbud (*Cercis canadensis*) as well as the cultivar C. 'Oklahoma.' I was also able to root for the first time, cuttings from a caddo sugar maple (*Acer saccharum* 'Caddo') with desirable form and fall color. Previous attempts to root cuttings of both species had been a failure.

Crape myrtle softwood cuttings were the main species used in the moderated environment. Softwood cuttings of *Lagerstroemia* 'Royal Velvet', 'Dynamite', and 'Raspberry Sunday' rooted well with or without the reduced temperature. Since it was not possible to have both a standard and reduced temperature mist chamber, any data from the rooting of cuttings was confounded by variations in weather conditions during the rooting periods. The root development on the cuttings after 14 days in the mist was noticeably greater during two rooting cycles with cooling compared to two rooting cycles without cooling during July and August 1997.

ANOTHER HELPFUL PROCEDURE

The other modification of the rooting environment to aid rooting of softwood cuttings was to provide some mist during the nighttime hours to avoid dehydration. This was accomplished with a mechanical Dayton 5-min time clock model 2E356, with 2.5-sec trippers. Two trippers are used per 5-min cycle, one provides the full 2.5-sec mist which distributes more water to the extreme of the bench and less near the mist heads. The second tripper was ground off to provide about 1.5 sec of mist which causes mist to be more concentrated along the mist lines. The 5-min clock is controlled by a mechanical 24-h clock, Tork model 8001 with 96 trippers, where each tripper is about 15 min. For day misting, the 24-h clock is set to be on from daylight to dark as is customary during softwood cutting propagation. This allows the 5-min clock to run the mist cycles. For night misting, the 24-h clock is set to allow the 5-min clock to run for 15-min periods, $1/2$ h after dark, then 1 h later, 1 h later, then 15 min every 2 h for the rest of the night cycle.

I have used this procedure for 5 years and have found it superior to simply turning the mist off at dark. With a few mist periods during the night, the softwood cuttings do not dry out and leaf drop is reduced. I have observed no disease problems as a result of the procedure.

CONCLUSIONS

I have long felt that with difficult-to-root species, rooting problems are more a limitation of the propagation environment than the potential of the species to root. Lowering temperatures only a few degrees below the threshold of their upper temperature tolerance in the propagation environment can enhance rooting. The cooling procedures described, combined with short mist cycles during the day and misting at intervals during the night cycle help to minimize desiccation and enhance rooting of species previously thought impossible to root.