

After the hormone has been applied, the cuttings are stuck in a bottom-heated bench, filled with perlite. We try to keep the heat in the bench between 68° and 72°F. At present, we are considering going back to sand. The perlite seems to break-down and hold too much water after 2 or 3 years. The cuttings are stuck about 25 to 30 per sq. ft. They are watered in by hand and then, as needed, to keep the medium slightly moist to the touch and to keep the foliage moist.

During the period the cuttings are in the bench, they are drenched about three times with a Benlate solution (½ table-spoon to a gallon of water) to help prevent leaf drop.

About late May or early June the cuttings are potted, set in a lath house for one or two years, and then lined out.

EVERETT VAN HOF: How much Benlate did you use?

KATE MERCHANT: One-half tablespoon/gal warm water. This is drenched over the cuttings.

PETER VERMEULEN: What was your bench temperature?

KATE MERCHANT: From 68° to 72°F.

ELWIN ORTON: What was the air temperature?

KATE MERCHANT: We do not try to heat the air. Whatever it is that day. We just heat under the bench. Last year, in a cold period, we had ice on the inside of the greenhouse walls, but the cuttings rooted well.

ELWIN ORTON: If you could keep the air at about 50°F and the medium at 70°F, you could up your percentage to 100%.

TOM MCCLOUD: Are your cuttings under mist?

KATE MERCHANT: No, hand-watered. We water the cuttings in well when we stick them, and then water as needed to keep the foliage damp.

## **ROOTING CUTTINGS IN OUTDOOR MIST BEDS**

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We have been using outdoor mist beds at our nursery for 5 years. They are an alternative to a costly greenhouse structure and the use of an expensive energy source.

The beds are made of cement blocks, mortared together, and set into the ground 16 in., or the depth of 2 blocks. The medium is coarse sand filled to the top of the first block. In 1982, we insulated one bed with 1 in thick rigid foam (polyisocyanurate.  $R = 7.2$  at  $68^{\circ}\text{F.}$ ) (1). The bottom insulation was sloped toward the middle with a 3 in space for drainage. The sides have 16 in. of insulation. Sand is used to grade the slope level. Lead cable is then laid down 4 in. apart on the sand and  $\frac{1}{4}$  in. mesh hardware cloth is laid over the cable to help disperse the heat and protect the cable. The temperature controls for the medium give us  $70^{\circ}\text{F}$  at the root zone. In 1984, it took 676 kilowatt-hours to heat 225 sq ft of bed at a cost of \$67.60. Collection of cuttings for narrow-leaved evergreens begins at mid-April and must be completed before growth starts. Seven *Thuja* cultivars are taken first and are stuck in a bed without bottom heat — since they root readily in summer without heat. Thirteen cultivars of *Taxus* are taken next, followed by 15 cultivars of *Juniperus*; both are stuck in a heated bed.

The mist system is made of  $\frac{3}{4}$  in PVC pipe and Flora Mist nozzles. The pipe runs the length of the bed and is controlled by one 24-hour clock and one intermittent clock.

Rooting takes place in 7 to 10 weeks, but the cuttings are not lifted until September 1st. Beginning 3 weeks before lifting, the cuttings receive two applications of liquid fertilizer (Peters 20-20-20) at the rate of 200 ppm at 10-day intervals. The *Taxus* and *Thuja* roots are trimmed, planted in outdoor beds, and shaded with lath. At first, we mulched after planting, but experienced lower stem splitting, especially on *Thuja*. Now, mulching is delayed until late November, and we have no damage.

We feel that by moving *Taxus* and *Thuja* in early September, the cuttings have enough time to produce roots in the fall with little heaving. We have observed that *Taxus* 'Densiformis' (*T. cuspidata* 'Densa'? Bot.Ed.) cuttings, when rooted in winter and planted in spring, produce a growth flush of  $\frac{1}{2}$  to 1 in., but cuttings rooted in the summer and planted in September put on 6 to 7 in. of growth the first growing season. The *Juniper* cultivars remain in place all winter and are covered with pine branches for shade. They are potted into 1-gal containers in early spring.

Softwood cutting propagation begins the first of June and the cuttings are stuck in a deep bed or cold frame. This bed is 3 ft deep, 6 ft wide, and 50 ft long. The medium is sand and perlite (1:1, v/v). This bed has no bottom heat but is covered with a 4 mil white poly film left over from winter storage

houses. A frame of  $\frac{3}{4}$  in. water pipe is used to hold the poly. The tent has doors and louvers at each end. White poly is used to avoid heat build up. White poly does not inhibit rooting; in fact, the cuttings root very well (2).

Almost all of the softwood cuttings remain in place for the winter. We put 2 layers of  $\frac{1}{4}$  in. microfoam over the tops of the cuttings and then cover the bed with sash made of filon. This is then covered with another layer of polyfoam, followed by white poly that is nailed to the sides. We maintained a temperature of 32°F at the top of the cuttings when the outside temperature was -17°F. In the summer of 1983 we stuck 1,670 *Cornus florida* 'Rubra' cuttings and potted 1,420 the next spring.

#### LITERATURE CITED

1. McGuire, J.J., C.G. McKiel, S. MacDonald, 1983. A comparison of different heat sources in outdoor mist beds. *Proc. Inter. Plant Prop. Soc.* 33:373-383.
2. Pellett, N.C., D. Dippre, and A. Hazelrigg, 1983. Outdoor rooting under a white polyethylene tent. *Proc. Inter. Plant Prop. Soc.* 33:366-373.

VOICE: How do you keep your plastic pipe from sagging and your nozzles from dripping after they shut off?

ROBERT GOUVEIA: We have a series of 2 × 2 in. oak boards that go across and the pipe sits on them.

RALPH SHUGERT: *Berberis thunbergii* 'Atropurpurea Nana' [*B. thunbergii* 'Crimson Pygmy'] cuttings are left under the mist for how long?

ROBERT GOUVEIA: It depends on how soon they root. We watch them and take them out as soon as they are well rooted. They do not do well under prolonged mist. The time averages 8 to 10 weeks.

JIM SAMPSON: Do you have any special tricks for transplanting *Stewartia* cuttings in spring? We experience tremendous losses.

ROBERT GOUVEIA: We keep them in the flat until we see leaves. I do not get excited about moving them too quickly. We also pot them up in the greenhouse and watch them closely.

JIM SAMPSON: We wait until we have leaves, but we still have losses. We have had some luck with the fungicide, Subdue.

ED MEZITT: We had trouble with hot water heat in our outdoor beds and finally gave up on heating. Do you find any difference in rooting without heat?

ROBERT GOUVEIA: Yes. *Taxus* cuttings the first year did not have heat outside and by September they were not ready to transplant.

ED MEZITT: I was talking about deciduous softwood cuttings.

ROBERT GOUVEIA: They do not have bottom heat.

RICHARD WOLFF: Did you find any effect of reduced light? We have a similar set up and observed no effect.

ROBERT GOUVEIA: The reduced light does not appear to be a problem.

CAMERON SMITH: Polybutylene, used as a piping for hot water in beds, is specifically made not to be damaged by freezing. This is not so for polyethylene and PVC.

WILLIAM STUDEBAKER: How often do you change your sand.

ROBERT GOUVEIA: We take it out every 2 years.

## **HARDWOOD CUTTING PROPAGATION AT MCKAY NURSERY**

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Propagation by hardwood cuttings is an important part of the propagation procedures at McKay Nursery. Hardwood cutting propagation has several important advantages over other methods;

1. It is the second most economical method of propagation — after seedlings.

2. Liners from hardwood cuttings are larger than those from softwood cuttings.

3. The cuttings do not require special handling in storage.

4. The cuttings are more easily transplanted.

A limiting factor is the many stock plants necessary to make large numbers of hardwood cuttings.

Our hardwood cuttings are prepared and stuck at two times of the year — fall and spring. We prefer fall cuttings as