EFFICIENCY TECHNIQUES IN PROPAGATION: BOTTOM HEAT

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We are always looking for the best system for root growth on our cuttings and a better and more efficient way of heating our propagation area. After looking at many different methods used throughout the indoor foliage industry in our area, we installed a hot water, bottom heating system. We decided to use a boiler we already had on the nursery. The only problem we had was that our boiler was being used for steam. Once we had the boiler changed over to heat water, rather than produce steam, we were ready to begin construction.

In the summer of 1984, we hired an engineering firm to design the system and assist us with the installation. The total area we were going to heat was 25,000 ft.^{2}. Our boiler was a Kewanne, 1,800,000 B.T.U. heating capacity.

The system consists of 3-in. main lines running from boiler on the discharge side to the middle of the greenhouse. From there it branches both ways down the middle of the greenhouse with 2½-in., 2-in., 1½-in., and 1-in. pipe. These main lines are then connected to header pipes that are 9½ ft. long. On the header pipes are 19 half inch thinwall PVC pipe that run the length of the beds to another header pipe. These beds are 50 ft. long and the PVC pipes are spaced every six in. There are four beds per house, and each house is 108 × 21 ft. We have a 2-ft. walk down the middle of each house.

The header pipes at the end of each bed are connected to the return lines that take the water back to the boiler to be reheated. On these headers we have a valve to bleed the air out of each bed.

All the header pipes are connected to both the main line and return lines with rubber PVC pipe. The glue was a special grey PVC glue used for heating systems. All the pipe for the heating system was installed in the ground.

The water from the boiler is pumped out at 115°F and returns to the boiler at 95°F. The water is pumped through the system by a five H.P. centrifugal pump mounted on the return side of the boiler. The boiler is equipped with many safety devices to prevent water from getting too hot or too cold or building up too much pressure or from having a burner misfire, just to mention a few.

The whole heating system is controlled by a soil thermostat located in a pot filled with soil in the middle of the greenhouses. Our

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system is set to maintain 70°F soil temperature during the months that we heat. With soil temperature at 70°F the average air temperature is 60°F.

The advantages are constant 70°F soil temperature; more even distribution of heat; quicker rooting times, which yield faster turnover of crops; and cost efficiency. The disadvantages are trapped air in lines that stops water flow, the main problem, and ruptured lines due to the thinness of the pipe wall and the fact that people step on the lines.

The boiler heats 25,000 ft.^{2} of growing area at a cost of 29¢ per ft^2. From the first of November, 1985 to the end of February, 1986, we used 7500 gal. of diesel fuel at an average cost of 97¢ per gal. Using half 2¼-in. pots and half 3½-in. pots, the 25,000 ft.^{2} of growing area will hold approximately 500,000 units at one time. During that four month heating period, we will turn two crops or 1,000,000 units. This gives us a cost of .00725¢ per pot for heating.

It has been our observation that during the winter months, the harder to root plants such as *Raphiolepis, Juniperus* spp., and *Ilex* spp., root in four to five weeks and are ready to move out in six to eight weeks for planting. The easier to root material rooted and was ready to move out for planting in two to three weeks.

We at Cypress Creek Nursery have been very pleased with the hot water unit for heating. The faster production of the liners has been, by far, the most cost effective change. The unit once installed and running properly has proved to be far better than we had anticipated.