NEW PROPAGATION HOUSE USING PLASTIC PIPE BOTTOM HEAT

JAMES H. KYLE

Spring Hill Nurseries Co.
Tipp City, Ohio 45371

The past few years have shown a need for additional propagation space at Spring Hill Nurseries. One specific crop which we wanted to expand was evergreen liners.

Over the years we have rooted *Taxus*, *Juniperus*, and *Thuja* species in many ways. Cuttings have been stuck in outdoor frames, greenhouse benches, flats on greenhouse benches moved outdoors when rooted, and even some under outdoor mist. We wanted to expand using the best of what we had done in the past. A good production area was to be built with reliable control of heat and other environmental conditions. The space would have to be flexible to use for other crops.

The 180 x 15 ft poly tunnel was constructed like other houses in the area. The floor, however, was submerged 2 ft underground. A hole was excavated 3 ft deep, sloping to a 12 inch drain tile at one end. Pipes were driven into the ground to support the structural hoops. A concrete footer was poured to support precast concrete slabs, with 2 inches of styrofoam insulation on the outside. These slabs act as sidewalls and retain the soil.

Cuttings were stuck in coarse sand and the flats placed on the floor of the house. Originally we planned to use electric cable, but the cost of a new electrical service together with the cost of the electric cables caused us to look at other methods.

The other choices were copper pipe, iron pipe, or plastic pipe. Copper pipe and iron pipe are short-lived because of electrolysis when buried in the ground. Plastic pipe has been used in homes for hot and cold water, but when I contacted a heating engineer he said it was an insulator and he was not sure if it would be satisfactory for heat. However, it does not deteriorate under the ground like iron or copper pipe.

Once the decision was made to proceed with CPVC plastic pipe, the problem was sizing the pipe and boiler. The only charts available were snow-melting for iron and copper pipe, none for plastic.

The decision was made to use 1/2 inch plastic pipe on 6 inch centers. This pipe was buried half way in 8 inches of sand. The cast iron boiler was sized according to the amount of pipe installed; however, with the low temperature (140°F) of operation it was oversized.

The boiler (Figure 1) was installed mid-way in the house so each end could be controlled separately. A thermostatic control, with a capillary tube buried in the sand, gives positive temperature control at the rooting zone. Plastic pipe will not hold up at temperatures over 180°F so dual boiler controls, one overriding the other by 10°F were installed to prevent over heating. Heavy duty Bell and Gosset circulating pumps are run continuously to give even heating throughout the house. Antifreeze was put in the circulation system to protect from freezing in case of heat failure.

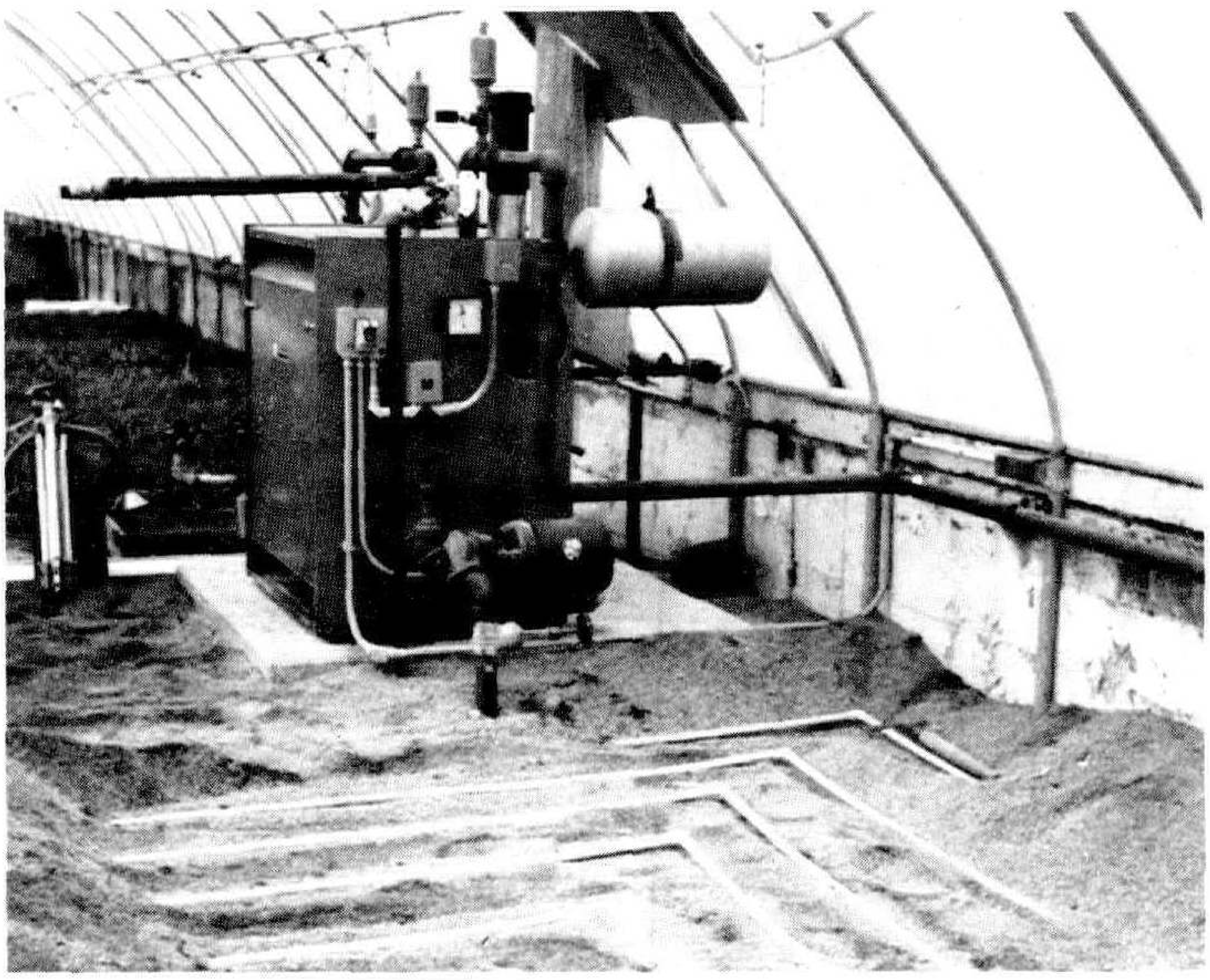

Figure 1. Boiler, circulating pump, and plastic pipe (exposed for picture).

For environmental control inside the house, a Windmaster Model DC241H fan, was installed with a motorized louver at the opposite end. Universal model 150FA heaters were hung at each end to be used in case of boiler failure or elimination of high humidity. The natural gas shortage necessitated installation of propane for this house. We have the necessary parts on hand to convert to natural gas. All other houses in the area have natural gas heaters.

Our propagator, Mr. Andy Brumbaugh, stuck 204,600 evergreen cuttings using a 5 sec dip of 50 grains NAA plus 50 ml isopropyl alcohol and 500 ml water. These cuttings were stuck in December and january. most were rooted within 60 days. the rooting temperature was held at 68° to 72°F and all but 100 or less rooted. (Figure 2).

Figure 2. Cuttings stuck in coarse sand in flats.

The buried pipe gave us good bottom heat with a cool top temperature. A high humidity was present until the hot days of spring. The poly was then painted with white latex paint to aid in cooling the house. During the early summer the cuttings were shaded with Saran shade cloth. It was removed in late July to harden off the cuttings prior to planting in field beds. A mist system has been installed for summer production and direct-seeded perennials make use of the bottom heat in early fall.

The house cost $2.41/sq. ft. to build. However, with an estimated life of 10 years or more, we feel the cost is reasonable. Electric cable could have been installed at 37 cents less per square foot, but at our electricity rate, cost of operation would have more than doubled. Propane for the operation of the boiler from November 27, 1972 to May 10, 1973 cost $747.00. This is a cost of 0.00364 cents per rooted cutting. If conditions change and we can switch to natural gas we expect to save an additional 40%.

Records show we have a direct cost of 0.00939 cents each to root cuttings. This includes all labor, heat, electricity, chemicals, and poly. We have not included overhead and invested capital in this cost.

We had excellent results the first year with this house, but to the best of my knowledge plastic pipe has not been tested and proven for heating. I would only recommend its use on a trial basis. Extreme care is necessary when cementing all couplings to prevent leaks. Air pressure testing, prior to filling with liquid, is advised.

LITERATURE CITED

1. Laurie, A., Kiplinger, D.C. and Nelson, K.S., 1958. Greenhouse Heating and Cooling. *Commercial Flower Forcing.*
2. Smith, E.M. and Powell, C.C. 1973. The effects of temperature on rooting of evergreen cuttings. *Nursery Notes,* The Ohio State University.
3. ________, Hydronic Heating & Cooling Systems 1970. *Bell and Gosset Training Manual*, Morton Grove, Ill.
4. Stroombeek, E. 1958. The propagation of softwood cuttings in the fog house. *Proc. Int. Plant Prop. Soc.*
5. Schultz, E.W. 1963. Plant propagation in plastic houses. *Proc. Int. Plant Prop. Soc.*

BRUCE BRIGGS: Have you had to go back and make any repairs to the plastic lines?

JIM KYLE: No; we took extreme care in assembling the lines and the temperature of the water is never heated over 140°F. The lines are bedded in sand.

CHARLIE HESS: What rooting medium are you using?

JIM KYLE: Coarse sand.

LARRY CARVILLE: Are you using 4 mil, double wall, inflated poly?

JIM KYLE: No, it is a single layer of 6 mil. There is no reason to use double poly; we're concerned only with supplying bottom heat, it could freeze on top as far as I'm concerned.

PRESIDENT TUKEY: Our next speaker, Gied Stroombeek, is going to tell us about an inflated, controlled-temperature propagating structure.