FLOOR HEATING OF GREENHOUSES[1]

There has been considerable interest in greenhouse floor heating. The response of plants to warm root temperatures has been well known. Benches have been used to elevate plants from the cold soil and in many instances, heating pipes are installed under the bench to increase soil temperatures.

The use of porous concrete has become popular for greenhouse floors. Porous concrete provides a solid surface, controls weeds, and yet, allows excess irrigation water to drain though. This type of floor offers the opportunity for placing pipe in the floor and creating a

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radiant heating system for the greenhouse similar to what has been used in home and industry for many years.

The success of the warm floor porous concrete design has been confirmed by the research done on the Solar Energy projects at Rutgers University's Agricultural Engineering Department for the past 3 years. One component of that system is a floor composite of stones and water capped with 3" of porous concrete and contained by a 20-mil PVC liner. Solar energy is collected by passing water stored in the floor through the solar collectors. The warmed water in the floor creates a radiant heating system. With the solar floor storage unit, temperature distribution is very even. Results of tests conducted with the solar system and with pipes placed in a porous concrete floor have indicated an economic pipe spacing of 12"-18", depending upon the crops grown.

The warm floor should be viewed as a supplement to a greenhouse heating system. The floor cannot deliver all the heat required by the greenhouse. The floor system, however, may allow the operator to lower night temperatures by 5°F, reducing the size of the total heating system. Initial research at Rutgers and other articles in the popular press have indicated that a warmer root temperature may allow for a lower ambient air temperature than normally recommended.

Present information indicates that polyethylene pipe, 80 psi test thinwall, offers the best design for economy, corrosion resistance and labor of installation. To avoid uneven floor heat, 90°F to 100°F water is used in the piping system. Nylon fittings are recommended, with double clamping to avoid the possibility of leakage. If warmer water is to be used for seed germination or other high temperature requirement, the pipe spacing should be reduced to 8".

Present data indicate that up to 20 BTU/Hour are given off to the greenhouse from each square foot of floor with a 90°F average water temperature in the plastic pipe loop and a 60°F ambient temperature for potted plant production on the floor. If flats are used and rightly spaced approximately 15 BTU/Hour/Square foot is available.

Things to remember concerning floor heating systems for greenhouses:

1. The system does not entirely heat the greenhouse. It can provide approximately 25 percent of the requirement of a double glazed structure.
2. Water temperature in the pipe loop should not exceed 100°F for uniform floor temperatures.
3. Nylon fittings should be used on the plastic pipe system.
4. The entire floor should be insulated if the water table is within 6 feet of the soil surface.
5. Some ambient air temperature reduction may be achieved in some crops with warm root temperature. Make changes slowly and observe the crop carefully.

The warm floor concept may have fringe benefits. It may be possible to eliminate benches with some crops which require no hand labor throughout the season. An additional benefit is the heat storage capacity of the floor. In the event of a heating system failure, the warm floor can help carry the greenhouse through a cold night without the crop freezing.

New information will be forthcoming. Most sorely needed is information on the crop response to the system. At the moment, it appears that the floor heating system has advantages for many growers.

(Adapted from Floor Heating of Greenhouses by W.J. Roberts and D.R. Mears, Engineering Department, Cook College, — Rutgers University, New Brunswick, NJ 08903.)

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