Grower 101:

Using Insulation To Save Energy And Money

Insulation is one of the first measures to consider for energy savings. Available in many materials and forms, it is easy to install, lasts a long time and quickly pays for itself.

By John Bartok, Jr.

Although there is considerable interest by growers in installing alternate fuel heating systems, the payback for tightening up and insulating a greenhouse is usually much shorter. First, the cost of a new heating system is expensive. Second, the cost and supply of the alternate fuel can vary considerably.

Insulation is available in many forms and materials. The most common materials utilize the principle that air is a good insulator. Air trapped in foam bubbles or the tiny spaces in fiberglass insulation create many barriers to heat movement. Some materials also use gas rather than air. Insulation board with an aluminum facing has increased resistance to heat loss due to reflecting the infrared component of the heat back.

The air film at a wall surface also provides insulation. The effectiveness of the air film depends on the surface conditions and the air velocity next to the surface. The air layer on the glazing inside the greenhouse is almost four times more effective than the air layer on the outside in a 15-mph wind.

The effectiveness of the dead air between two layers of 8-mm polycarbonate structured sheets is better than an 8- to 12-inch space between the two layers of an inflated poly cover. In the poly cover, air movement is created by convection currents that carry the heat from the inner layer to the outer layer where it is conducted to the outside. But even so, the ➧

Top: *Single or multiple energy screens provide a heat barrier, reduce the heated area and can reflect heat back to the growing area. Payback is usually 2-3 years.* ***Bottom:*** *Perimeter insulation from 2 ft. below ground to bench height increases soil temperature and decreases wall temperature, saving considerable heat. (Photos: John Bartok, Jr.)*

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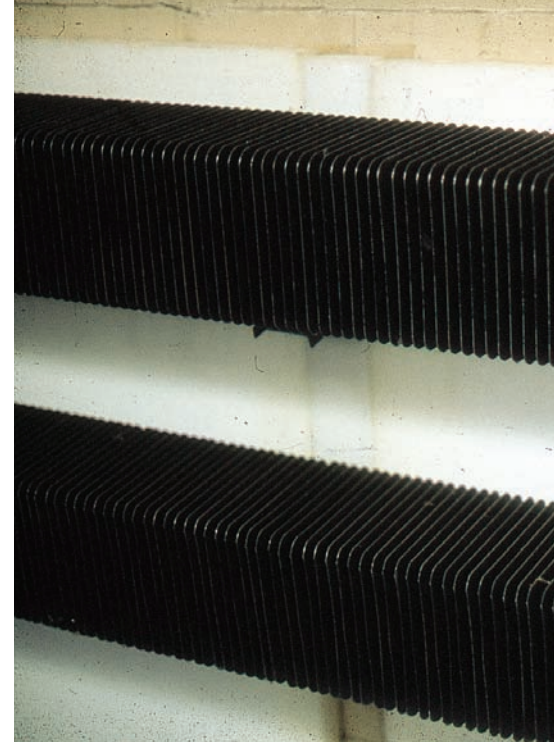
addition of the second layer can reduce heat loss more than 30 percent.

Energy Screens

One of the greatest savings in a greenhouse can be achieved by adding a movable energy screen. These systems are supported or suspended from cable or monofilament and provide an insulation layer when closed that shields a large roof area. Typically, a system can be installed in a gutter-connected greenhouse for $1.50-$3 per sq.ft. Some growers are now adding additional screens to gain even greater heat savings.

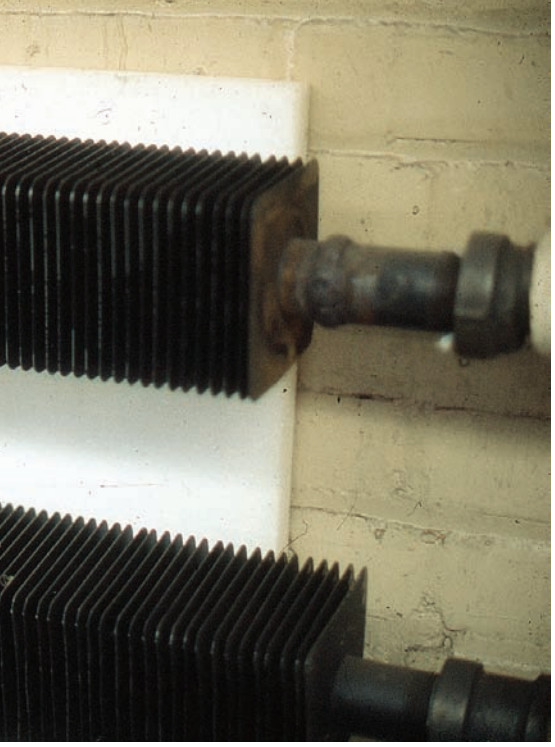
A wide variety of materials, including porous and non-porous, are available. Materials with heat savings from 20 to 75 percent are



available. A common installation for an open-roof greenhouse is to use an open weave material for shading. This allows the heat to flow through and escape through the open roof. A second energy screen with a solid weave is installed to trap the heat underneath at night.

Several growers are now experimenting with a clear, third screen manufactured by L.S. Svensson that has a light transmission greater than 80 percent and energy savings of about 45 percent. The clear screen can be left deployed during the daytime in the winter. This traps additional heat but still allows sufficient light to reach plants. When building a new gutter-connected greenhouse, allow at least 24 inches of space above the energy truss for energy and shade screens.

Although more difficult to install, some manufacturers are developing systems for freestanding hoophouses. Both track and cable systems were used during the



*Top: Insulation board or aluminum foil can reduce the wall temperature behind sidewall heat pipes by as much as 40° F. **Bottom:** Insulating the north wall of the greenhouse, although it saves energy, reduces the reflected light from clouds and snow.*

energy crisis of the 1980s. Another system being researched is a foam system that fills the cavity between two layers of plastic. It insulates at night and dissipates to a liquid and is returned to a storage tank during the daytime.

Foundation Insulation

Adding insulation board below ground around the perimeter of a greenhouse can save significant heat and keep the soil along the walls 10-20° F warmer. If the insulation is extended up to bench height, greater heat savings will result. In existing houses, an inch of insulation board or even a layer of aluminum-faced building paper placed along the sidewall behind heat pipes or benches will pay for itself in less than one heating season. For example, applying 2 inches of foam insulation to a 3-ft.-high kneewall or sidewall will save about 400 gals. of fuel oil or 550 therms of natural gas in a 28x100-ft. greenhouse over a heating season in northern climates.

The addition of insulation to a greenhouse's north endwall is controversial. In cloudy climates, much of the light received by the crop is reflected from the clouds, snow and the surrounding area. A fixed opaque insulation on any glazing, including the north wall, reduces light levels, affects the crop quality and may possibly delay flowering. In sunny climates, reflective board insulation on the north wall will reduce heat loss up to 10 percent. A good compromise may be to ➧

insulate the entire perimeter foundation up to bench height.

Headhouses And Auxiliary Buildings

Insulating and tightening up auxiliary buildings, such as packing areas, potting sheds, maintenance buildings and offices, makes sense. These areas are frequently heated to a higher temperature than the greenhouse. Fiberglass insulation with a vapor barrier placed on the winter-heated side should be installed in the walls and ceiling. Today, a minimum of 10 inches in the ceiling and 4-6 inches in the walls is recommended. These buildings will be much warmer in the winter and cooler in the summer. Some states have rebate programs available to offset the cost.

Adding 1 inch of pipe insulation to a 2-inch-diameter pipe in an area where heat is not needed will save about $10 per linear ft. worth of heat over the heating season.

Pipe Insulation

Considerable fuel is wasted each year from bare heating system pipes in areas where heat is not needed, such as boiler rooms, headhouses and above energy curtains. Adding 1-inch-thick fiberglass or foam insulation to a three-fourth-inch pipe will save about $4 per linear ft. and on a 2-inch pipe about $10 per linear ft. over the heating season. Installation is simple and can be done by unskilled workers in slack time. The payback is usually less than two years. GPN

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