Wall Insulation–Save Up to 10% On Your Heating Bill

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Heat loss from a single thickness glass or plastic covered greenhouse wall is about 10 times greater than from the same wall covered with an inch of foam insulation. Naturally we can't insulate the whole glazed area but it makes sense to insulate areas such as sidewalls and endwalls to bench height and the foundation below grade.

There are many types of insulation materials that can be used. Their effectiveness is designated by an R-value, the amount of resis-

tance to heat transfer. The higher the value, the better the insulation and the less heat that is transferred. Table 1 lists the R-value for some of the materials and wall assemblies commonly found in a greenhouse.

Heat loss is also dependent on the difference between the temperature maintained in the greenhouse and the temperature outside. On very cold nights, the heat loss is much greater than on mild nights.

Walls can be covered with opaque material from the foundation up to plant height. Rigid board insulation such as extruded polystyrene, polyurethane or isocyanurate are common and can be attached to the wall or buried below ground. Slightly increased insulation value as well as some mechanical protection can be obtained from these materials covered with aluminum foil. Polystyrene beadboard should not be used unless it is covered with aluminum foil as it tends to absorb moisture reducing its insulation value.

An uninsulated concrete greenhouse foundation wall has an R-value of 1.3. An inch of polystyrene added to the wall increases the R-value to 5.3 and reduces heat loss by 75%.

Insulation may be added to the outside or inside of the foundation. When placed on the outside, the wall becomes part of the mass of the building that stores solar heat and reduces greenhouse air temperature fluctuations. It is also a better choice if the interior heat pipes are located against the wall. The insulation should be protected from mechanical damage and weather by covering with fiber reinforced cement board, pressure treated plywood or metal siding.

Inside insulation needs less weatherproofing. Reflective coatings of a board insulation should face inward but not touch perimeter heat pipes. If possible, extend the insulation to a depth of 12" to 24" below the floor to block heat loss at the perimeter.

Whether the insulation should cover the entire north glazed wall or just part of it depends on several factors. In cold climates, much of the light received by the crop in the winter is reflected from the clouds and surrounding snow cover. In these areas a fixed opaque insulation may reduce the light level and affect crop quality and flowering time.

In sunny winter climates, reflective board insulation on the north wall will reduce heat loss and actually increase light levels on the plants near the north wall.

Adding insulation to the glass portion of sidewalls should be done with care. Snow that slides off the roof is normally melted by heat escaping through the glazing. When insulation is added greater glass breakage can occur.

AIRCAP or ASTRO-BUBBLE, the bubble plastic commonly used as a packaging material, has been used effectively as a sidewall insulation

over glass. It can be applied using vacuum cups or double sided tape. An energy savings of 20% to 30% can be expected for the area that is insulated. Light reduction will be in the range of 10% to 15%. It should not be placed on roofs where snow may overload the structure. The cost is about $.08 per sq. ft. and will last several seasons.

A low cost material that has a payback of a month or two is foil-faced kraft paper. Costing about $.04 per sq. ft. it is a good material to use where the space behind the heat pipes is too small for insulation board. Testing done several years ago at one of UConn's greenhouses showed a 40°F reduction in sidewall temperature when foil was placed behind the heat pipes. This material is available at most lumberyards.

Therma-Wall, available from Ludy Greenhouse Mfg. Corp., P.O. Box 141, New Madison, OH 45346, is foam covered on one or both sides by aluminum sheets. It adapts well as a sidewall material for remodeling or new construction. Closure extrusions make for an efficient, tight installation. Cost is $2 to $4 per sq. ft. depending on thickness and facing.

Growers have several good alternatives for wall insulation with short to medium payback periods. With fuel prices going up again, an investment in upgrading your facilities can pay dividends for many years.

Table 1: Heat Flow Through Various Insulation and Wall Assemblies.

Material	R-Value
Expanded polystyrene foam board - 1"	4.0
Expanded polyurethane foam board - 1"	6.2
Fiberglass	4.0
Air Cap/Astro Bubble	1.4
Aluminum foil	3.3
Acrylic or polycarbonate structured sheet	1.7
Concrete block - 8"	2.0
Concrete wall - 6"	1.3
Plywood - 1/2"	1.4
Concrete block or plywood with 1" polyurethane foam board	7.7
Therma-Wall - 1 1/2" with aluminum both sides	8