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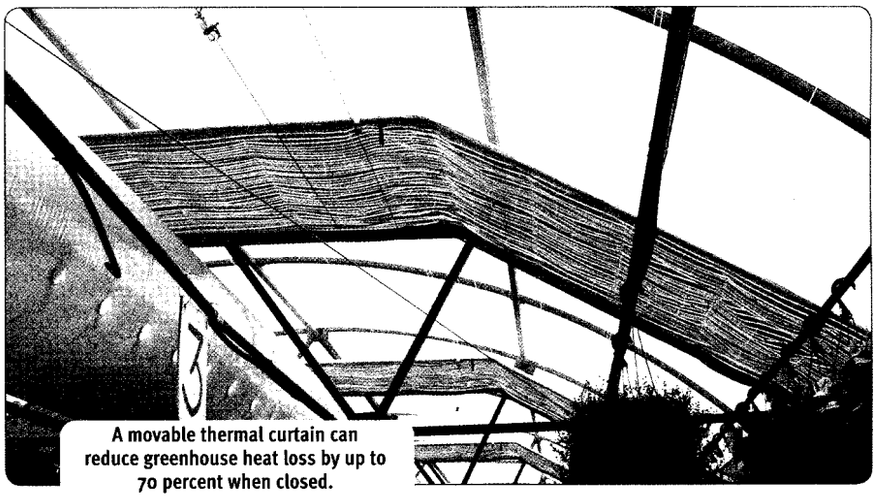
Cut energy costs and increase production efficiency by looking at 10 key areas in your greenhouse.

By Scott Sanford

Reduce energy use for greenhouse heating



A movable thermal curtain can reduce greenhouse heat loss by up to 70 percent when closed.

NATURAL GAS AND PROPANE prices have been increasing over the past few years due to increasing demand, tight supplies and political unrest. Here are some things that can be done in the greenhouse to reduce the impact of higher energy costs.

1. Glazing materials.

Due to higher energy costs, double-wall glazing materials have become more popular such as double-wall polycarbonate and double polyethylene films. Double-wall glazing can reduce heating costs by 40 percent compared to single-wall materials but at the expense of lower light transmission (about 80 percent for double-wall glazing versus about 90 percent for single-layer).

Double polyethylene film also reduces infiltration losses due to fewer joints, when compared with glass. The poly will allow infrared radiation (heat) to transmit out of the greenhouse more rapidly on clear nights. However, additives can be incorporated into poly films to reduce the IR heat loss and reduce overall energy use by 15-20 percent.

Condensation on the inside of a poly film-covered greenhouse can reduce thermal radiation loss by up to 50 percent; however, condensation also reduces light levels at the plant level by 15-25 percent. Dripping condensation can also lead to plant-quality issues. IR-treated films are generally combined with an anti-condensate treatment resulting in a cost of about $40 more for a 30-by-96-foot greenhouse compared to untreated films, about $10 per year. A standard poly film is used as the outer film and the IR-treated film is placed on the inside with the anti-condensate side facing inward.

2. Insulation.

Growers with greenhouses equipped with bench systems can insulate the side walls, end walls and perimeter with 1- or 2-inch foam insulation board. Perimeter insulation should be dug in 12-24 inches deep and can be extended up to the bench top height. The foam should have a protective cover such as aluminum foil to protect it from ultraviolet light deterioration and to reduce fire hazards.

3. Energy-saving blankets.

Monitoring indicates that 70-80 percent of the energy to heat a greenhouse is required at night so reducing heat loss during that time can pay big dividends. A movable thermal curtain can reduce heat loss up to 70 percent when it's closed. The higher the shading factor of the curtain, the higher the energy savings. Three types of blanket materials can serve both as a summer shade or provide winter heat retention.

Non-porous aluminized materials can provide energy savings up to 70 percent when closed. However, condensation can pool on top of the curtain and cause the system to fail under the weight of the pooling water.

Porous blankets allow water to drain through them but only provide energy savings of about 20 percent when closed due to the higher exchange of air.

Semi-porous materials provide energy savings up to 70 percent when closed but allow moisture to migrate through the curtain to eliminate water from pooling on top of the curtain and is the recommended material.

These systems can be manually or mechanically opened and closed.

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Installation costs range from $2-$3.75 per square foot depending on the size of greenhouse, blanket material and type of track/drive system used. A typical greenhouse can realize a 30-50 percent overall energy savings from an energy curtain system.

4. Infiltration losses.

Infiltration is air movement into and out of a greenhouse through cracks and small openings in the shell of the building. New construction greenhouses can range from 0.5 to 1.5 air exchanges per hour while old construction glass-glazed greenhouses can range from one to four air exchanges per hour.

Reducing infiltration losses mainly involves plugging unintended openings and making sure doors and louvers seal. Pay particular attention to openings in coverings such as around heater vents or fans and at the edges of the greenhouse covering or glazing and make sure there are no gaps around the foundation.

5. Glass house infiltration.

Glass greenhouses inherently have more infiltration because of the larger number of joints and seals. Covering glass greenhouses with a

single or double layer of poly film reduces infiltration and heating losses up to 50 percent. The cover can be installed permanently or just during winter.

Reducing infiltration can lead to increased humidity levels and a rapid depletion of carbon dioxide. The light levels will be reduced by 18 percent because of the additional glazing layers, which needs to be taken into account in any economic analysis.

6. Furnace checkup.

Have furnaces and unit heaters serviced and tested yearly. Replace older inefficient furnaces. A 2-percent increase in efficiency will save about 179 gallons of fuel oil, 259 gallons of propane or 250 therms of natural gas per year for a 30-by-96-foot greenhouse in Northern climates.

7. Unit heater selection.

Unit heaters are very popular because of their low cost, high reliability and ease of installation. There are three types: gravity vented, power vented and separated combustion. All have a thermal efficiency of about 80 percent, but vary greatly when seasonal efficiency is considered.

The gravity vent has a seasonal efficiency of 65 percent, while the power vent heater has a seasonal efficiency of 78 percent. This difference is due to the air that is continuously exiting the greenhouse through the vents on gravity vented unit heaters. The cost difference between the two heaters is about $100 while the energy savings is 13 percent. In Northern climates, the additional cost for a power-vented unit will pay for itself in less than 45 days in energy savings.

The separated combustion heater has a seasonal efficiency of 80 percent because it uses outside air for combustion along with a power vent exhaust.

8. Bottom heating.

Moving heating pipes and air distribution systems from overhead to under-bench, on-floor or in-floor can save up to 20 percent in heating costs and results in faster plant growth. A microclimate is created for the plants when bottom heating is used. A heating pipe under the gutters will still be needed on gutter-connected greenhouses to aid in melting snow.

9. Alternate fuels.

If a central heating system is used, it may be easier to take advantage of alternate fuels. Before investing in alternate fuel, consider all costs (labor, fuel acquisition, refueling, labor, maintenance, transportation, ash removal and ash disposal) and check with state and local authorities about permits and ash disposal requirements. Outdoor cord-wood stoves are not permitted in many areas due to the high smoke emissions. A more energy-efficient alternative is pellet boilers or furnaces. These units automatically meter fuel into the boiler as the heating load requires and generally have very low emissions.

10. Space use.

Increasing the number of plants grown in a greenhouse will reduce production costs. This usually means reducing aisles or using tiers or racks to increase plant density.

Peninsular bench layout. A traditional straight-row bench system uses about 60 percent of the floor area for plant production while a peninsular bench layout provides more than 70 percent of the floor area for growing.

Movable benches. Movable growing systems can increase plant production area to about 84 percent. There are two types of movable systems: moving benches and transport trays. Both provide high space efficiency and can increase labor efficiency and reduce energy use per plant.

The disadvantage associated with movable benches is the limited space for maneuvering. This can be overcome by using a narrow portable belt conveyor or an overhead trolley to move plants.

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