(/bottrap)

Nursery Management (/magazine/) / September 2018 (/magazine/issue/september-2018)

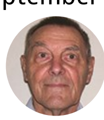
Temperature control

Features - Growing Under Cover // Heating

Options for heating cold frames, high tunnels and overwintering structures.

SUBSCRIBE (/SUBSCRIBE/)

September 11, 2018


John W. Bartok Jr. (/author/2411)


Photos by John W. Bartok

Low-cost growing structures are used by many growers for short-term production space or winter plant protection. These are not usually heated, but sometimes minimal heat is needed to keep the temperature above freezing.

The amount of heat needed can be approximated by the formula HL = A x U x T where:

HL = Heat loss (Btu/hr)

A = Surface area of structure (sq ft), U = U-value - heat loss factor (Btu/hr – sq ft-°F) – Use 1.25 for single layer glazing, 0.8 for double layer, or 0.7 for double wall polycarbonate.

T = temperature difference between inside and outside (°F) on the coldest night.

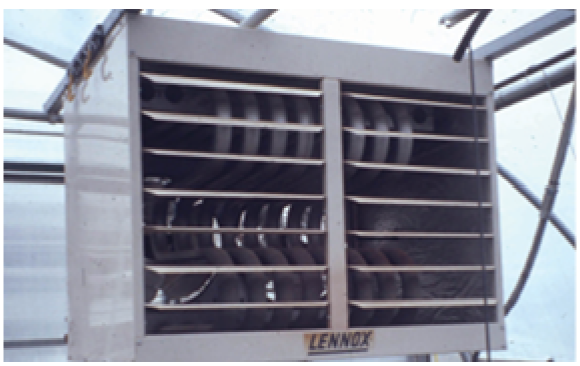
The following discusses some of the options that growers must provide heat.

Hot air systems – As compared to water systems, air heating systems have the advantage of being low cost and easy to shut down when heat is no longer needed. Most have a blower that provides some heat distribution. Installing horizontal air flow (HAF) or perforated poly ducting can increase the uniformity of the heat in longer structures. A disadvantage to heated air systems is that very little heat gets down to the root zone in plants placed on the floor.

Vented equipment should be selected to exhaust flue gases that may contain sulfur or ethylene. Because these heaters will have limited use, look for used equipment.

Unit heaters – These are available in many sizes to accommodate most protected areas. They are usually supported from the hoops or from a frame that gets them above the plants. The fuel source can be natural gas, propane or fuel oil. High efficiency condensing gas heaters (93 percent) are available but these may have problems with the condensate freezing in cold weather unless they are drained.

Floor furnaces – These furnaces are available in sizes from 50,000 to 500,000 Btu/hr that can be fired with fossil fuels. A model with a blower instead of a fan that is attached to perforated poly ducting works well for under bench heat.



Unit heaters with HAF air circulation are a good choice for temporary heat.

Hot water systems – There are more options with water systems. The advantages include better distribution of heat with the resulting more uniform temperature. The disadvantages include generally more expensive equipment and the system may have to be drained or blown out if it is shut down during freezing weather. Root zone heat – Locating the distribution system on benches, on the floor or buried underground will provide heat throughout the whole plant area. Heat sources can be low-cost domestic water heaters, in-line instantaneous water heaters or high efficiency condensing boilers. An additional heat source may be needed on very cold nights as there is limited heat from the root zone. Storing the excess heat from a greenhouse heating system in an insulated heat storage tank during the day and then using this heated water at night may make an economical system.

A biomass fired outdoor boiler could also provide hot water. A disadvantage is that it requires recharging late in the evening and early in the morning on cold nights. Distribution of heat could be low-output fin radiation, PEX or virgin black poly tubing or an EPDM tubing heat mat.

Heat exchangers – Water to air heat exchangers, available in many outputs, can provide heat distribution if you have a good supply of hot water. They are inexpensive as compared to fossil fired unit heaters. Location is important to get good heat distribution in low or narrow structures. Installing HAF fans can help to distribute the heat.

Low output aluminum fin radiation – This may be a good choice in cold frames or overwintering houses where a limited amount of heat is needed. Depending on the style, these have an output of 50 to 150 Btu/linear foot at 150-degree water temperature. They need to be installed so that they can be drained or blown out if the system is shut down during cold weather.

Temperature control for this heating equipment should be accurate electronic thermostats located in the center of the growing area. If freezing temperature is the main concern, locate the thermostat just above plant height. Be sure that the structure is tight to reduce cold infiltration air. Place some max-min thermometers in the growing area to monitor temperature extremes.

John is an agricultural engineer, an emeritus extension professor at the University of Connecticut and a regular contributor to Greenhouse Management. He is an author, consultant and certified technical service provider doing greenhouse energy audits for USDA grant programs in New England. jbartok@rcn.com (mailto:jbartok@rcn.com)

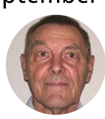
overwintering (/keyword/overwintering/) growing under cover (/keyword/growing-under-cover/) high tunnels (/keyword/high-tunnels/)

Growing taller

Features - Growing Under Cover // Greenhouse Construction

Learn how to choose the right greenhouse gutter height.

September 11, 2018



John W. Bartok Jr. (/author/2411)

When building a new greenhouse consider the advantages of a taller gutter height.
Photo by John W. Bartok

Over the past few years, the gutter height on new greenhouses has been increasing. Greenhouses built during the energy crisis of the 1970s usually had an 8-foot height to conserve energy. Today for various reasons, 12 feet is minimum and 16 feet is the standard with some houses being built with gutters more than 20 feet. What are the advantages of going taller? The following comments may help you decide.

Greater air volume means slower temperature change. Increasing the height from 12 feet to 16 feet increases the volume by more than 20 percent. The larger volume takes a longer time to heat up or cool down.

Natural ventilation is more effective. Natural ventilation systems operate on the principle that heat is removed by a pressure difference created by wind and temperature gradients. The ridge of a taller house receives more wind currents creating a better draft. Buoyancy is the other component. Cool air near the floor becomes lighter as it is heated and rises toward the roof. The greater distance between the floor and the roof vent, the greater the temperature difference.

Light reaching the plants is more uniform. It may not be obvious but the farther the greenhouse frame and fixtures are above the floor, the lighter the shadows become. This can result in greater uniformity and more light reaching into the lower canopy.

Room for additional energy/shade screens. Screens are valuable for both saving energy in the winter and excluding heat in the summer. A single screen can save up to 40 percent of the winter heat. Adding a second screen can reduce heat loss another 10 to 15 percent. At least 12 inches is needed to install a second screen. Usually these are located at the top and bottom cord of the energy truss for tight closure.

There are some negatives that can offset the advantages. The taller greenhouse is more expensive to build. The wind load on a tall house is increased due to the greater wall surface area. Larger support members and more bracing may be needed for the extra load. Also, additional wall glazing is needed. This amounts to 1 to 1.5 percent of the total surface area for each foot of additional height.

Heating costs are increased. As heat loss is directly related to the surface area of the greenhouse, the extra wall area adds some to the heat needed. Larger heaters may be needed.

Greater ventilation fan capacity is needed. For greenhouse gutter heights less than 12 feet, most engineers calculate fan capacity at 8 cfm/square foot of floor area. Recommendations for heights above that are better designed with fan capacity at 10 cfm/square foot.

Increased horizontal air flow (HAF) fan capacity is needed. As there is more air to move, it requires more power to move it. A good recommendation for houses with greater than a 12-foot gutter height would be to design with about 2.5 cfm of fan capacity for each square foot of floor area.

Labor costs may increase. If taller crops will be grown, employees may have to use elevating platform equipment to tend and harvest them.

When planning a new gutter-connected greenhouse, review the above factors based on the crops to be grown and the level of environment control desired.

John is an agricultural engineer, an emeritus extension professor at the University of Connecticut and a regular contributor to Greenhouse Management, a sister publication. He is an author, consultant and certified technical service provider doing greenhouse energy audits for USDA grant programs in New England. jbartok@rcn.com (mailto:jbartok@rcn.com)

growing under cover (/keyword/growing-under-cover/) greenhouse (/keyword/greenhouse/)

Don't get foiled by the flea beetle

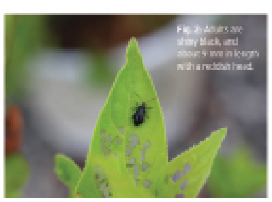
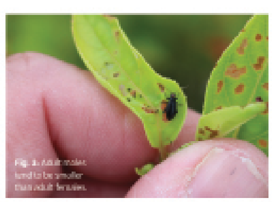
Features - Insect Control

Nurseries need to be aggressive when it comes to controlling the redheaded flea beetle.

SUBSCRIBE (/SUBSCRIBE/)

September 11, 2018

Raymond A. Cloyd and Nathan J. Herrick (/author/13068)

1) Fig. 1: Eggs are oblong, approximately 1.0 mm in length, and creamy-white.

2) Fig. 2: Adults are shiny black, and about 9 mm in length with a reddish head.

3) Fig. 3: Adult males tend to be smaller than adult females.

4) Fig. 4: Adults feed on the upper and lower leaf surfaces causing leaf skeletonization.

5) Fig. 5: Severe damage to plants reduces aesthetic quality and marketability.

The redheaded flea beetle, *Systena frontalis*, has emerged as a major insect pest in nursery production systems. Adults feed on many different ornamental plants; however, based on our experience and feedback from producers, *Itea* sp., *Hydrangea* sp., *Cornus* sp., and *Weigela* sp., are highly susceptible to redheaded flea beetle adults. In fact, specific cultivars tend to be more susceptible, including *Itea virginica* 'Little Henry,' *Hydrangea paniculata* 'Vanilla-Strawberry' and 'Bobo,' *Cornus sericea* 'Kelseyi,' and *Weigela florida* 'Fine Wine.' We have been conducting studies on redheaded flea beetle for five years at Loma Vista Nursery, one of the largest nursery operations in Kansas, and have obtained information related to biology and management.

Left: (Fig. 6) The redheaded flea beetle feeds on many types of ornamentals. Right: (Fig. 7) Plants were isolated inside a greenhouse to monitor insect activity.
Photos courtesy of Raymond Cloyd

Biology

The life cycle of the redheaded flea beetle consists of an egg, larva, pupa, and adult.

Eggs are oblong, approximately 1.0 mm in length, and creamy-white (Figure 1). Larvae are 5-10 mm long, creamy white, and have a brown head capsule when mature. The last body segment has a fleshy projection that curves upward, with hairs on the end. There are three larval instars. Larvae are located belowground in the growing medium/soil, and feed on plant roots. However, the larvae are less of a problem to plants than the adults. There is minimal information available on the pupal stage.

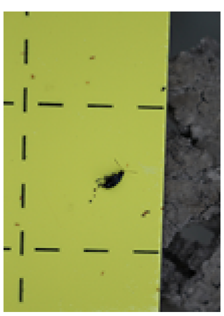


Fig. 8: Redheaded flea beetles emerge as adults from containers.

Adults are shiny black, and about 9 mm in length with a reddish head (Figures 2 and 3). Adult males tend to be smaller than adult females. Females lay eggs individually. Adults possess an enlarged hind femur that allows them to jump/hop similar to a flea—hence the common name. Adults feed on the upper and lower leaf surfaces causing leaf skeletonization and creating holes in leaves (Figures 4 through 6). In addition, adults deposit black fecal material on leaves during feeding.

On *Itea virginica* 'Little Henry,' adults tend to feed on the new growth where leaves are folded and pointing upward. Severe damage to plants reduces aesthetic quality and marketability. Adults can also feed on many weeds commonly associated with nursery production including common lambsquarters (*Chenopodium album*), pigweed (*Amaranthus* sp.), smartweed (*Polygonum* sp.), and velvetleaf (*Abutilon theophrasti*) among several other species. Adults may be present from June through November with possibly two to three generations per year; however, this is contingent on temperature and availability of suitable host plants. The number of generations in Kansas has not been determined. Based on experiments in which field containers of plants were collected and placed into a greenhouse (Figure 7), we have quantitatively shown that redheaded flea beetles emerge as adults from containers (Figure 8). From May 21 to June 18, 2018, we collected 10 redheaded flea beetle adults from 30 containers associated with *I. virginica* and *H. paniculata* plants.

Fig. 9: Adult flea beetles can be found on the surface of growing media.

Management

Weed removal from within the nursery, including containers, will help reduce potential food sources of redheaded flea beetle adults. Redheaded flea beetle adults may enter nurseries from surrounding vegetation; especially if the plants or weeds are a viable host. It is important to develop and implement an aggressive scouting program by monitoring for adults weekly, focusing on plants that are highly susceptible to redheaded flea beetle adults, and then conducting spray applications accordingly. Apply insecticides weekly when adults are active. We have found, in our efficacy trials, the following insecticides to be effective in protecting plants from damage caused by redheaded flea beetle adults: acetamiprid (TriStar), dinotefuran (Safari), and cyfluthrin (Tempo). Thorough coverage of all plants is important, as well as, the growing medium/soil as redheaded flea beetle adults may be able to sense changes in air pressure. Consequently, the adults will hop off plant leaves and land on the surface of the growing medium/soil (Figure 9) or the leaves of adjacent plants. Systemic insecticides can be used; however, adults still have to feed on plant leaves to be negatively affected, and depending on numbers, may still cause substantial aesthetic damage.

Author's note: We want to thank Michael Sellers, Duane Huss, Thomas Minter and Lyndsi Oestmann of Loma Vista Nursery in Ottawa, Kansas, for their assistance and allowing us to conduct research on the redheaded flea beetle.

Raymond A. Cloyd is a professor and Nathan J. Herrick is a research associate in the Department of Entomology at Kansas State University.

pests (/keyword/pests/) beetles (/keyword/beetles/)

VIDEOS

(/amleo-frost-guard-video.aspx)

Protect plants with frost guards (/amleo-frost-guard-video.aspx)


Creating an environment
for success
ATLAS
GREENHOUSE
PROFESSIONAL GREENHOUSE MANUFACTURERS