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COLORADO STATE UNIVERSITY EXTENSION SERVICE

The hobby greenhouse

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Quick Facts

- Greenhouse structures are available in unassembled packages, complete and ready to set on a foundation, or they can be custom designed.
- A structure at least 200 square feet (18 square meters) in area should be considered.
- There are three basic greenhouse types: the attached lean-to, the window design and the free-standing structure.
- When selecting a site for a greenhouse, exposure, accessibility of utilities and aesthetics should be considered.
- An eastern exposure is most desirable for a greenhouse.
- Greenhouses can be constructed of wood, pipe, steel or aluminum, with covers of glass, fiberglass reinforced plastic or film plastics.
- In general to heat a greenhouse, 200 BTUs/hour/square foot (.1 sq m) of ground area should be provided; in cooling a structure, 13 cubic feet (.4 cu m) per millimeter of air exchange/square foot (.1 sq m) of ground area should be used in calculating fan size.

A hobby greenhouse can be one of the most useful investments a family can make. Such a facility not only allows the thumb to stay "green" all year but provides an atmosphere for learning about plants and can be an asset to climbing food prices.

Planning the Structure

Greenhouse structures are available in all sizes, shapes and degrees of durability. They can be purchased in unassembled packages, complete, ready to set on a foundation, or can be custom designed for a specific need. Three major factors always should be considered when planning for a greenhouse: 1) automatic heating and cooling systems; 2) at least 200 square feet (18 square meters) of floor area, especially when a family is involved, and 3) consultation with zoning, building code and tax assessor personnel who also can assist with the budget.

Type of Structure

Most greenhouse structures fall into three categories. The attached lean-to type normally has one sidewall as a part of a house, garage or other out building. It costs somewhat less to construct and operate but can have some drawbacks in cooling or ventilating capabilities.

The window design is attached outside a strategically located window, which is often chosen to attract public attention. It is almost impossible to maintain a uniform temperature in the window type because heat is dependent on home conditions. Ventilation during periods of high solar radiation is also a common problem.

The free-standing structure provides the most versatility in regard to maintaining a good greenhouse environment. It is easy to ventilate throughout the year and is relatively easy to expand if the need arises.

Locating the Structure

Many factors must be considered when choosing a site for a greenhouse. The first should be the orientation or exposure. In the case of a lean-to or window structure, an east, south, west and north exposure, respectively, is the most desirable. All greenhouse structures should be located well out of the shadows of trees, buildings or other structures, especially during winter months.

Accessibility of utilities also is important as extension of water, gas and electricity lines can be costly. If such lines are extended underground, they usually have to be placed in separate trenches.

Another factor concerns aesthetics. Not only the structure but its location should fit into the landscape of the surrounding property and be compatible with existing architecture.

Building Materials

A framework is available in a wide variety of materials: wood, pipe, steel or aluminum. Wooden structures can be made of redwood or other readily available materials. Local lumber yards usually can make the required trusses and supply all other materials for the superstructure. If wood is considered, select types **without** wood preservatives in the form of Penta or Creosote. Wood coated with these materials yields toxic fumes harmful to plants. Copper napthanate forms of preservatives are safe products to use around plants.

All nonredwood lumber should be painted with a good oil base white paint. Paint containing tung oil usually is available from commercial greenhouse suppliers. Mercury-type paints should not be used in the greenhouse.

Galvanized pipe often is used for fiberglass covered structures as well as the increasingly popular double layer plastic film covers. Parts required for pipe construction usually can be obtained only from a greenhouse supplier. Black pipe, if painted properly, can be much cheaper. Steel structures involving angle iron are not recommended because of construction and maintenance difficulties.

Aluminum is associated with fiberglass panel coverings and is the only material to use for a glass-covered house. All parts are available from the manufacturer.

Covers

Glass, until recent years, has been the most commonly used greenhouse covering. It is subject to hail and accident damage and definitely needs to be shaded during summer months. Research at CSU in the 1960s showed that superior growth was obtained from carnation plants grown under fiberglass reinforced plastic (FRP).

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FRP panels have become common greenhouse coverings. Certain criteria should be considered with purchasing panels, namely, the presence of acrylic modifiers, ultra violet (UV) inhibitors and a Tedlar film laminated to the outside to increase panel longevity. Panels with these characteristics are classed as greenhouse grades and are not normally obtained through lumber yards.

"Clear" panels contribute to the best plant growth. However, colored panels of yellow, coral, light pink and violet are acceptable for plants requiring low light, such as orchids or violets. Green-colored coverings are not conducive to good plant growth.

Film plastics have aided more in the energy crisis than other coverings. The double-layer installation (air inflated) reduces heat loss from 20 to 30 percent. Properly applied greenhouse grade film plastics containing UV inhibitors will last 18 to 30 months in Colorado.

Controlling the Environment

One of the most important factors involving greenhouse management is the ability to control the plant environment, so that near-optimum growing conditions can exist.

Temperature requirements—Most plants are placed into two temperature categories, warm and cool crops. It is difficult for the small hobby greenhouse operator to have two separate areas for both warm and cool temperature requirements, thus a compromise is needed. Secondly, most plants do better when the night temperature is approximately 10°F (6°C) lower than the day temperatures. The following temperature program allows the greenhouse enthusiast to grow a number of cool and warm temperature crops.

Night: Heat to 56°-57°F (13°-14°C)
Day: Heat to 56°-57°F (13°-14°C)
Cool to 65°-70°F (18°-21°C)

Heating—A good heating system is very important but can create problems. During periods of subzero temperatures, all cracks in the greenhouse structure "ice over" and free air exchange is eliminated. All heating systems for greenhouses must have a proper amount of fresh air coming to the burner area. If inadequate air is present, improper combustion occurs and ethylene will be a by-product which remains in the greenhouse and damages plants. It is recommended by the Public Service Company that a fresh-air inlet be installed near any heating unit at a ratio of one square inch (6.5 sq centimeters) of inlet opening for every 2,000 BTUs of heater rating.

If possible, it is desirable to have the heater or combustion chamber installed outside the greenhouse in order to eliminate combustion problems. Direct-vent, wall-mounted heaters have proven worthy for greenhouses. Hot water systems provide the most uniform heat and can be the least expensive to operate. Forced-air heating units, such as those used in homes, work well, provided they are vented properly.

As a general rule, 200 BTUs per hour per square foot (.1 sq m) ground area will be required to maintain 50°F (10°C) temperatures inside a standard designed house with -10°F (-23°C) outside. The lean-to and air-inflated structures have a 10-20 percent lower heat requirement.

Cooling and ventilating—A greenhouse is a collector of solar heat. On winter days with full sun and an outside temperature of 20°F (-6.6°C), the temperature in the greenhouse can reach to more than 65°F (18°C). Hardly a week goes by that some ventilation isn't needed. A plastic-tube system is an ideal way to control greenhouse temperatures throughout late fall, winter and early spring.

Greenhouses covering less than 200 square feet (18 sq m) of ground area can be cooled effectively with an evaporative cooler (swamp cooler). Such cooling systems produce a positive pressure; thus, ventilating louvers should be installed in the peak of each gable and at least one or more vents should be placed opposite the air inlet. Coolers should be selected on the basis of 15 to 20 cubic feet (.5 to .6 cu m) per minute (CFM) of air exchange per square foot (.1 sq m) of floor area.

Larger greenhouse designs are easier to cool with a fan-and-pad system. Special "nonloading" fans and cooling-pad systems are available through greenhouse supply companies. A design factor of 13 CFM per square foot (.4 cu m per minute per .1 square meter) of floor area should be used to calculate the fan size.

When an aspen excelsior pad is used for evaporative cooling in a hobby house, a ratio of 5.6 square feet (.5 sq m) of pad area is required for every 1,000 CFM (30 cu m per min) of cooling fan capacity. The cooling pad and fan should be at plant height and the air pulled across the longest distance of the house. Automated or manually operated louvers or ventilators will be needed to cover the pad area. A complete picture of the automatic ventilating system is shown in Figure 1.

Controls—A heating, humidity, cooling or ventilating system is only as effective as the method of control. Solid-state, automatic control systems now are available at reasonable prices. For ease of management, the heating and cooling systems should be controlled by thermostats placed in a protected area in the center of the greenhouse and in close proximity to the plants. Ideally, all thermostats and thermometers should be placed in an aspirated box or tube. It should be designed so the air is pulled across the instruments and no solar or extraneous heat reaches them. A battery operated high- and low-temperature alarm system also should be considered.

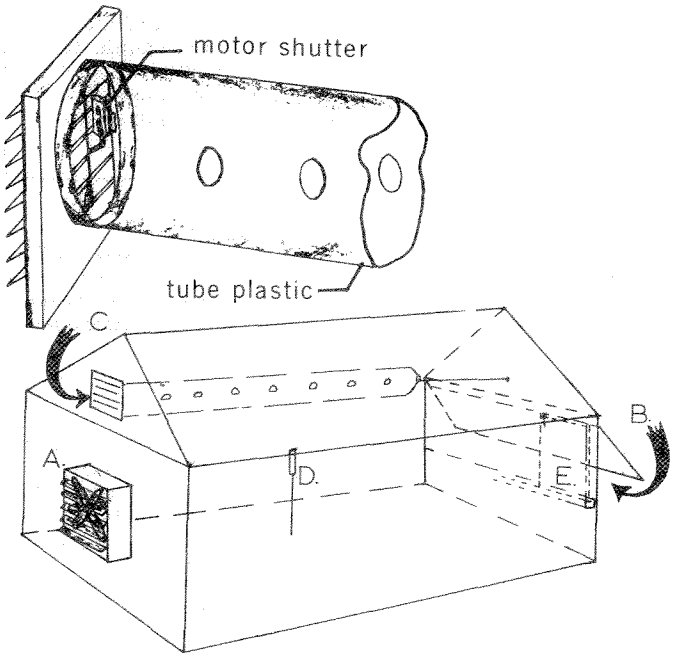

Figure 1: Components of a ventilated greenhouse.
A. Thermostatically-controlled exhaust fan for year-round operation.
B. Manual or automatic ventilator for summer cooling.
C. Convection tube ventilation for winter cooling when near ventilator is closed.
D. Aspirated container for control system.
E. Cooling pad system, completely across opening.