

SUNSHINE GARDENHOUSE

greenhouses for gardeners

User Guide

Sunshine GardenHouse™

PO Box 2068

Longview, WA 98632

Toll Free: 888.272.9333

www.gardenhouse.com

Revised 9/29/03 JD



Most of the GardenHouse User's Guide has been excerpted from [Solar Greenhouses for the Home](#), with permission from its publisher, Northeast Regional Agricultural Engineering Service.

Your GardenHouse

The importance of following the basic rules for enjoying your Gardenhouse operation cannot be overemphasized. Venting and heating at the proper time helps maintain a healthy environment for plant growth. General cleanliness reduces the chances for pests and diseases to breed.

Cultural techniques may require modification from those used in the garden. Soil should be lighter and drain better than many garden soils. Whether cultivation is in ground bed, raised beds, or containers, it is necessary to prepare a soil mix especially for indoor use and change it annually. Drainage holes in containers are as important as light soil. Watering and fertilizing is based on plant growth, which is directly related to light and temperature.

Fewer pests are usually found in a gardenhouse garden; however, the pests must be controlled. Due to the enclosed nature of the gardenhouse, interrelated ventilation, and proximity of family and pets, extreme caution must be exercised when using pesticides. As much as possible use innocuous controls such as yellow sticky bands for white fly, soap solutions for spider mites and alcohol swabs for mealy bug control.

Good air circulation reduces fungus diseases. In late spring, summer, and early fall, ventilation to the outside will be necessary to prevent excessive temperature buildup. In many areas, unless shade and ventilation are provided, the summer temperatures will be too high for optimum vegetable growth in your gardenhouse.

Following are just a few suggestions for good greenhouse management:

1. **Do not use ammonia cleaners or brushes on the glazing.** Mild detergents or soaps and a soft cloth are recommended.
2. Don't smoke in the GardenHouse.
3. Keep working surfaces clean.
4. Keep all utensils and tools clean; wash them after use.
5. Wash pots and flats after use.
6. Keep a log of crop production, fertilization, and insect control.
7. Wash hands before handling plants and after applying fertilizer or insecticides.
8. Don't allow weeds to grow next to the GardenHouse.
9. Check any new plants coming in for evidence of pests or disease.
10. Use soilless materials such as perlite, vermiculite, peat moss, and sand in various combinations.
11. Remove dead foliage from plants and soil.
12. Destroy diseased plants; do not leave them near the GardenHouse.

Lighting the GardenHouse

Supplementing sunlight with electric light is expensive and seldom done in either the commercial or hobby greenhouse. Light can be added to extend the day length or interrupt the night to control bud initiation of some flowers. Sometimes fluorescent lighting is installed to grow plants under benches.

CAUTION: The GardenHouse is a damp, well-grounded area. Poor wiring can be deadly. Be sure any wiring meets national and local electrical codes. A ground fault circuit interrupter (GFCI) should be installed to prevent a shock and possible death. Hire a licensed electrician to wire the GardenHouse if you are not familiar with electrical codes and wiring.

Light Intensity

Light intensity is measured in footcandles or, in the metric system, in lux (1 lux = 10.76 footcandles). The natural light level on a bright, clear day can reach 10,000 to 12,000 footcandles while on a rainy day with heavy overcast, it may be as low as 200 footcandles.

Indoor Seedling Germinations and Propagation

Germinating seeds and cuttings being propagated need light levels of about 600 to 2000 footcandles to grow well. Four 40-watt cold white fluorescent lamps mounted 4" away from plants in a white reflector on 2" centers will provide about 1000 footcandles of illumination. Special high wattage fluorescent lamps must be used to achieve higher levels at greater distances. The soil is sometimes heated to speed germination.

Ingenuity and care are required to maintain optimum temperatures and humidity for propagation or germination under electric lights. Many plants do well when daytime temperatures are 80°F and night temperatures are 10° to 15° less. Night temperatures should not drop below 60°F.

Most small wood stoves need to be refueled every 4 to 6 hours and do not keep a fire overnight. A wood stove can be used to heat water to be stored in a tank for overnight use. Although more difficult to ignite, coal burned in a stove will provide heat for 12 hours or longer.

Recent research has shown that many plants respond according to the average temperature held during the night. Thus a wood or coal stove might be fired to start the evening so the gardenhouse temperature is 70°. Then, as the fuel burns down, the temperature may slowly drop to 50° by morning. But the plants in the gardenhouse grow as if they are kept at 60° all night.

Heater Size

- **HEATING:** The formula for determining the proper heater size for winter operation of a single-glazed gardenhouse is shown below. Because of the improved insulation of the double-wall polycarbonate, you reduce this requirement by 40%.

$$A \times D = \text{BTU's} \times \text{Insulation Advantage} = \text{Reduced BTU's Needed}$$

A = Total surface area of the gardenhouse.

For a 6' x 8' GardenHouse, A = 240 square feet

For a 6' x 12' GardenHouse, A = 316 square feet

For a 8' x 12' GardenHouse, A = 400 square feet

D = Difference in degrees F between the gardenhouse temperature and the coldest winter temperature. **EXAMPLE:** Desired gardenhouse temperature is 55°, winter's lowest temperatures is 10°. So, 55° - 10° = 45°.

BTU's = British Thermal Units, the rating of heat output often listed on heating products. A wattage rating can be converted to BTU's by multiplying the watts x 3.413.

EXAMPLE: Using the 6' x 8' GardenHouse and temperatures above:

$$A = 240, D = 45, \text{ then, } 240 \times 45 = 11,025 \text{ BTU's}$$

Insulation Advantage = .6

$$\text{So, } 11,025 \times .6 = \underline{6,615} \text{ BTU's needed}$$

- **COOLING:** Virtually every climate has enough summer sun to overheat a gardenhouse. Moving the GardenHouse to a shady location, draping shade cloth over the GardenHouse or, in some areas, adding fans to assist circulation will be necessary to protect plants. An optional Shade Cloth Kit is available.

An exhaust fan should have the capacity to completely change the air in the GardenHouse within a couple of minutes. The 6' x 8' GardenHouse would require a fan rated at 285 CFM (cubic feet per minute) for maximum effect. The 6' x 12' would require 428 CFM, and the 8' x 12' would require 570 CFM.

Ornamentals

Many ornamental crops tolerate low light and cold temperature. During the coldest months, grow plants which tolerate 45°F or less, such as pocket book plant (calceolaria), cineraria, tulips, daffodils, begonias, bromeliads, geraniums and some orchids. Foliage and succulent plants which tolerate low temperatures include araucaria, citrus, fatsia, hederia, philodendron, podocarpus, agave, many cacti and lithops.

Vegetables

Table 1. Suitability of vegetable and herbs for production in the winter solar GardenHouse setting.

EXCELLENT	GOOD	FAIR	POOR
Swiss Chard	Cherry Tomatoes ²	Broccoli	Beans
Leaf Lettuce	Green Onions	Peppers ²	Corn
Celery	Cucumbers ¹ (European Type)	Large Tomatoes ²	Carrots
Kale	Garlic	Eggplant ²	Radishes
Turnips	Leek	Edible Pod Peas	Turnips
Mustard Greens	Cabbage		Melons ¹
Dill	Collards		Squash ¹
Spinach			
Oregano			
Parsley			
Marjoram			
Basil			
Fennel			

¹ Listed poor because they are pollinated naturally by bees. They could be hand pollinated and listed fair. European cucumbers are not noted since they require no pollination.

² Require warmer temperatures.

Table 2. General temperature Guidelines for best growth and quality of vegetable crops.

Tempeartures			Vegetables
Optimum	Minimum	Maximum	
55 - 75	45	85	Chicory, chives, garlic, leek, onion, salsify, shallot
60 - 65	40	75	Beet, broad bean, broccoli, Brussels sprouts, cabbage, chard, collard, horseradish, kale, kohlrabi, parsnip, radish, rutabaga, sorrel, spinach, turnip
60 - 70	50	80	Lima bean, snap bean
60 - 75	50	95	Sweet corn, Southern pea, New Zealand spinach
65 - 75	50	90	Chayote, pumpkin, squash
65 - 75	60	90	Cucumber, muskmelon
65 - 75	58	80	Sweet pepper, tomato
70 - 85	65	95	Eggplant, hot pepper, martynia, okra, roselle, seet potato, watermelon

The inexperienced grower can easily overproduce sometimes. Scheduling crops to meet your needs will come with experience and careful record keeping. Table 3 (below) suggests space requirements for vegetables for a family of four. Table 2 (above) outlines temperature guidelines for best growth and quality of vegetable crops.

Table 3. Space requirements for vegetables for a family of four.

Vegetable or Herb	Total Spacing (Square Feet)	Spacing (Inches)	Plants Needed (Number)
Swiss Chard	9	12	9
Leaf Lettuce	18	9	30
Celery	9	9	12
Greens	10	6	40
Spinach	10	6	40
Herbs (Dill and Fennel require more space than others)	15	6	4 each of 5 kinds
Cherry Tomatoes	6	12	6
Green Onions	6	3	72
Cucumbers	6	18	2
Garlic	2	3	12
Leek	2	3	12
Cabbage	12	12	12
Collards	10	12	10
Broccoli	10	12	10
Peppers, Hot	6	18	2
Peppers, Sweet	6	18	2
Large Tomatoes	6	24	3
Eggplant	2	24	1
Edible Pod Peas	10	3	40

Supplemental Heat

If the greenhouse is to be maintained warm enough for good plant growth during the entire winter, supplement heat is generally necessary. Several types of heaters are available.

The electric heater is convenient, clean, efficient, and easy to install; but electric energy is more expensive than other fuels. The heater should have a built-in thermostat and circulation fan. Adequate electrical supply and wiring is required, and the size of the existing electrical service may limit the number of new branch circuits which can be added to service the greenhouse.

Space heaters are commonly used to heat small GardenHouses. Some are completely self-contained units with fan and heat exchanger that burn either natural gas or LP gas. Other, not commonly used in small GardenHouses, have a fan and heat exchanger but use hot water or steam from a central boiler as the heat source. Space heaters are often hung overhead, but some fit through the wall so little space is lost and no special venting is required. Units with fans that blow air horizontally give more uniform temperature distribution than heaters that blow air vertically.

CAUTION: Some fuel-burning heaters must be vented to the outside because some of the products of combustion are toxic to both people and plants. Be sure air for combustion comes from outside the greenhouse. Portable oil-fueled space heaters, such as those used on construction projects, should not be used in GardenHouses.

Small kerosene burners are sold to heat small GardenHouses. These low-cost, handy units have no fan or thermostatic control, so temperatures fluctuate and are less uniform than in houses with more expensive heating systems. Even these small heaters should be vented to the outside. In tightly constructed houses these heaters can use enough oxygen to cause incomplete combustion which generates toxic gases. In addition, water vapor, formed as part of any combustion process, may cause high humidities and potential disease problems.

Electrical or gas-fired radiant panels hung over each bench or floor can be very efficient for small areas. Equipment may be expensive and hard to find, however.

CAUTION: Heat lamps should be suspended by chains or cables and not by the electrical cord.

Infrared lamps have been used to heat bedding plants grown in a greenhouse in the spring. These low-cost lamps are simple to install overhead so they do not require floor space. A 150 to 200 watt heat lamp suspended 32" above the bed will heat a 3' x 3' area 15° to 20° above the outside air temperatures. A thermostat can be installed to turn off lamps at 45° to 50° F.

A small wood or coal stove can be used, if the fuel can be purchased economically. The stove should be installed to meet all safety requirements, especially distances to combustibles. Purchase a stove designed for the fuel you intend to burn. It is difficult to burn coal in a stove designed for wood.