

# Hobby Greenhouse Operations and Practices

## Introduction

Perhaps there is no greater joy than owning a hobby greenhouse and entering a warm, dry room filled with green plants when there may be frost, wind, or rain outdoors. For many people, tending to a greenhouse is like entering a relaxing, private world, isolated from workaday worries as well as the weather. A greenhouse can be an absorbing hobby with the satisfaction of growing fragrant flowering plants, foliage plants, ingredients for fresh-picked salads in winter, transplants for the spring garden, or bouquets of cut flowers.

Do not be fooled, however, into believing that a hobby greenhouse does not involve some work. Constant attention is required at most times of the year. This often means every day during the summer unless automatic watering and ventilation systems are installed. During the year, there are always jobs to be done. But none of these chores have to be strenuous or tedious if tasks and the materials needed to accomplish them are arranged intelligently. The purpose of this publication is to provide information about tasks that should be done to have a well-run, efficient hobby greenhouse, one that is satisfying for the owner and a joy for the entire family. Information on hobby greenhouse construction and environmental maintenance equipment can be found in Extension publication ANR-1105, "Hobby Greenhouse Construction."

## The Plant Environment

Even though a greenhouse is an enclosed space, it is not isolated from the outside environment. Conditions within the greenhouse are constantly changing. Learn not only to see but also to feel changing conditions. Watch weather forecasts so that preemptive steps can be taken to compensate for changing outside conditions. Day length, light intensity, temperature, humidity, and precipitation frequency change hour to hour, day to day, and season to season. Greenhouse owners should be able to recognize these changes and alter environmental control equipment to keep the greenhouse environment optimum for plant growth.

Variations also exist within a greenhouse. Look and feel for patterns of light or shadow, low or high humidity, and stagnant or moving air. These patterns create microclimate differences from the greenhouse center to the walls. Take advantage of microclimate differences by placing plants in areas within the greenhouse suitable for their growth.

### *Light*

During the day, leaves of plants use the energy from sunlight combined with carbon dioxide from the air and water from the soil to manufacture sugar and oxygen in a process called photosynthesis. At night, plants burn sugar produced during the day and release the ener-

gy for maintenance and growth in a process called respiration. Photosynthesis and respiration can be viewed as opposing processes, one capturing energy, the other using it. Plants must receive enough light during the day not only to meet the needs of maintenance but also to have enough left over for growth.

Every plant species has its own requirement for light intensity. Most vegetables, cut flowers, and many flowering potted plants require high light intensity to grow well. Most foliage plants and some flowering potted plants require lower light intensity to grow. Under light intensity that is too low, plants exhibit slow growth, spindly, slender elongated stems, yellow lower leaves, and soft succulent growth. In some cases, they exhibit larger, thinner leaves and in others they exhibit smaller leaves and stem bending toward a light source (called phototropism). Under light intensity that is too high, plants exhibit smaller, light-green thick leaves, short thick stems and, in extreme cases, burned leaf margins or scorched blotches on the leaves.

Light intensity in the greenhouse is measured in foot candles (f.c.). A clear summer day may measure 10,000 f.c., while an overcast, winter day may measure 500 f.c. The amount of light needed for a person to read comfortably is about 20 f.c., while the light of a full moon is less than 1 f.c. Measuring the light available to plants requires

a simple, convenient tool called a light meter. It is the only way to be sure plants are receiving the correct amount of light. Light meters can be purchased from greenhouse supply companies for \$70 to \$120. Recommended light intensity ranges for specific plants can be found in books under the additional reading section of this publication.

The purpose of glazing (the transparent or translucent material such as glass covering a greenhouse) is to capture sunlight as well as to separate the interior greenhouse environment from the outside environment. During the summer, high light intensity can burn low-light requiring plants and raise interior temperatures excessively. Light intensity and heat load in the greenhouse can be reduced using one of several means of shading.

Shade fabric is a woven polyethylene cloth that can be purchased from greenhouse supply companies. It comes in weave densities ranging from 20 to 90 percent. It is more effective in heat reduction to purchase a size large enough to drape over the outside of the greenhouse rather than hanging the fabric inside. One problem with draping fabric over the outside of the greenhouse, however, is that it can interfere with vent operation. During the summer in Alabama, high light requiring plants can benefit from 30 to 40 percent shade while low light requiring plants may need 50 to 80 percent shade. Purchase shade fabric with grommets along the edges so the cloth can be tied down in case of strong wind.

One simple and inexpensive alternative is to purchase shade paint from a greenhouse supply company. Mix the paint with water according to the manufacturer's directions. Shade paint is a weak-binding latex paint that

is diluted and sprayed on the outside of the glazing. It is often applied in two applications, one light application in mid to late March and a second application in mid to late April. Shade paint is designed to weather off the glazing gradually over the summer and fall. However, it is frequently necessary to wash the glazing in late fall with soap and water and a long-handled brush to prevent unwanted light reduction in the winter.

Greenhouse blinds are regarded by many owners as the best shading alternative. Blinds can be purchased in a wide selection of roller types made with wood, plastic, or plastic-coated aluminum slats. Many owners mount blinds on the outside of the greenhouse that aid in heat reduction but like shade fabric can interfere with vent operation. Blinds designed to be mounted inside the greenhouse can be adjustable.

Most methods for increasing light intensity after a greenhouse is constructed are drastic, such as cutting down trees or removing other outdoor obstacles, or expensive, such as installing artificial light sources. However, plants can be spaced farther apart and objects such as hanging baskets can be taken down in the winter to reduce competition and shading. Painting as many interior surfaces as possible with white semigloss or gloss paint can also increase light intensity. Exterior latex works well but epoxy paint is even better. Paint benches, walls, doors, glazing supports, and even the floor, if possible, to reflect light. Another solution is to use a herbicide to kill all vegetation within 10 to 15 feet around the outside of the greenhouse and to spread white rock on the outside to reflect light into the greenhouse.

## ***Temperature***

Each plant species has an optimum and tolerable temperature range for growth. Plant growth and flowering are rapid within the optimum temperature range. Tolerable temperatures, which may be higher or lower than optimum, allow the plant to grow but at a reduced rate. Growth usually stops and plants may be damaged at temperatures outside the tolerable range. Recommended growing temperatures can be found in books such as those listed under the additional reading section of this publication. Generally, these recommendations are for minimum night temperatures because heating is required to maintain a minimum temperature for growth.

Most plant species grown in greenhouses are tropical or subtropical in origin and heating, when needed, to a 60 to 65 degrees F minimum night temperature works well. Exceptions to this recommendation include many cool-season plants such as primula, pansy, and some orchids. Cooler than optimum night temperatures will slow growth while warmer temperatures will speed growth. Daytime temperature should generally be 5 to 10 degrees F warmer on cloudy days and 10 to 15 degrees F warmer on sunny days than the night temperature. Excessively warm temperatures during the day or night, especially during cloudy weather, can reduce growth because respiration is increased and plants use sugars faster than photosynthesis can manufacture them.

Temperature requirements can also change with a plant's stage of growth. Generally, germinating seed and seedlings and rooting vegetative cuttings require warmer temperatures, plants growing vegetatively perform better under somewhat

cooler temperatures, and flowering plants need under even cooler temperatures. With a mix of plants at different stages of growth in the greenhouse, it may be difficult to select an ideal temperature; nonetheless, provision should be made for germinating seed and rooting cuttings in a warmer setting.

Greenhouse temperature maintenance equipment (fans, heaters, etc.) is commonly regulated by installing one to several thermostats depending on the number of devices that require control. Thermostats controlling heating equipment are set to the minimum desired temperature and cooling devices are set to the maximum desired temperature. Do not depend, however, on the accuracy of commercial thermostats. Instead, install a high/low thermometer next to the thermostats and adjust the thermostat set points according to the high/low thermometer. High/low thermometers record the low temperature at night and the high temperature during the day. They have two liquid-filled glass stems and a metal bar within the glass stems that moves as the temperature changes, but stays in place at the lowest and highest temperature readings. Record the temperatures and reset the high/low thermometer daily. The thermometer is reset by moving the metal bars with a magnet or by pressing a button on the face of the thermometer.

### ***Relative Humidity***

Relative humidity (RH) is a measure of how much water is dissolved in the air at a particular temperature expressed as a percentage. Generally, growth of many plants is relatively unaffected by RH between 45 percent and 85 percent. Plants growing at RH below 45 percent may grow slowly, have smaller

leaves, require watering more frequently, or develop burned leaf margins or leaf tips. Plants growing at RH above 85 percent are susceptible to fungal pathogens, especially if water condenses on the foliage.

Several conditions can occur in a greenhouse that result in problems caused by high or low RH. During the summer, high light, high temperature, and rapid air movement from fans can reduce RH to unacceptable levels. Shading to reduce light and temperature and using evaporative cooling (cooling pads) are the best solutions. RH can be raised for a short time by using a hose to wet down interior surfaces (walks, side walls, and open bench areas, but not plants). It is also advisable to keep the greenhouse full of plants because plants generate a lot of RH.

During the spring and fall, warm days followed by cool, clear nights cause rapid heat loss from the greenhouse, especially from the glazing material. Warm, moist interior air moving next to cool glazing material can drop to the dew point temperature and cause water to condense in droplets on the inside of the glazing material. These droplets run down the slope of the roof, grow larger, and then rain down on plants below creating ideal conditions for the growth of fungal pathogens. Two ways to reduce this problem is to avoid watering plants late in the day and to make sure the greenhouse floor drains well with no standing water or constant wet spots. The best way, however, to alleviate this problem is to wire a fan to a 24-hour time clock and set the fan to turn on for 30 to 60 minutes (depending on the size of the greenhouse) starting at 9:00 or 10:00 PM. The goal is to exchange the warm, moist interior air with cool, moist out-

side air, then allow the heating system to warm the air to its set point, thereby reducing the amount of water in the greenhouse air. Ironically, high RH and condensation are generally not a problem during the cold of winter because heating reduces the amount of water in the air.

### ***The Root Environment***

Underneath every healthy plant is a healthy root system. Although most of us know what a healthy plant looks like, few of us bother to learn what healthy roots look like. Learning the characteristics of healthy roots is one key to successful growing and diagnosing of plant problems. Drop plants out of their pots periodically and examine the roots. Roots may be thin, fibrous, and many-branched or thick and straight with few branches depending on the plant species. However, they should be more or less white, not brown or black. There should be root hair development just behind the root tip. Root hairs should be straight, not curled, discolored or absent. Roots should grow toward the bottom of the pot and, when mature, cover the entire soil volume. Disease, incorrect watering practices, poor soil, excessive fertilizer, or a combination of these factors can cause root problems.

### ***Potting Soil***

The major function of potting soil is to provide air (oxygen and carbon dioxide), plant support, and a constant supply of water and fertilizer nutrients to the roots. Roots take up oxygen and give off carbon dioxide in respiration to carry out their functions. Therefore, potting soil must have a sufficient number of large channels or pores to allow water to move through quickly and to allow air to exchange with the atmosphere. It should

also have a sufficient number of small pores to hold adequate water and fertilizer between applications. In addition, potting soil should be initially low in fertilizer, free from toxins or herbicides, standardized and uniform for consistent results, and free from diseases, insects, and weed seed. Soil from the yard cannot meet many of these criteria, especially once confined to a pot. Therefore, it should not be used in a potting soil for the greenhouse.

Most of the potting soils used in greenhouse growing are called soilless mixes. As the name implies, they do not contain soil from the ground. There are two choices for obtaining sufficient potting soil, either mix your own or purchase it commercially already prepared in bags from retail sources. Commercial potting soil is convenient and inexpensive, but unfortunately, no standards exist for content or quality. There may be a high variation among brands. Look for a brand with "Professional Potting Mix" on the label, then look for a list of contents. The potting mix should contain predominately peat moss, perlite, and/or vermiculite. Run a test in your greenhouse with several brands using different plants to see which one performs best. The advantage of mixing your own potting soil is that you have control over the content and quality. Recipes for three soilless potting soils are found in Table 1. Ingredients for mixing your own potting soil can be purchased from garden centers or greenhouse supply catalogs.

Soilless mixes are composed of two categories of components. The organic component gives potting soil the ability to absorb large amounts of water and fertilizer. Peat moss is used more than any other organic component, but composted bark

or composted byproducts (leaf mold, sewage sludge, etc.) can also be used. The drainage component improves the potting soil's ability to drain water and exchange oxygen and carbon dioxide with the air. Perlite and vermiculite are widely used, but sand (washed river sand) can also be used. Chemical additives can be blended in the potting soil when the organic and drainage components are mixed.

The pH of a potting soil is a measure of the acidity or alkalinity of the mix. The pH scale ranges from 1 to 14 with 7 being neutral. Kits or meters for testing potting media pH can be purchased from garden centers or greenhouse supply catalogs. Most plants grow well in a soilless potting soil with a 5.5 to 6.5 pH. However, a potting soil using peat moss as an organic component will have an unacceptably low pH. Dolomitic limestone, which also supplies calcium and magnesium needed for plant growth, is added to the potting soil at the time of mixing to raise the pH. It is both convenient and economical to add some fertilizer to the soil at the time of mixing. Superphosphate (rock phosphate), a commercial micronutrient formulation and a source of nitrogen and potassium can be added at mixing. Keep in mind that these rates will get plants off to a good

start, but additional fertilizer will be needed once plants establish.

Four cubic feet is a convenient amount of potting soil to mix at a time. This amount will fit into a 30-gallon, new or clean garbage can for storage and will fill approximately 171 4-inch pots, 93 5-inch pots, or 56 6-inch pots. Begin by constructing a box from plywood with a 1-cubic foot **inside** dimension. Measure the organic and drainage ingredients according to Table 1 and mix them with a shovel on a clean surface to prevent contamination by root pathogens (cover dirty surfaces with plastic). Add just enough water to the mix to barely darken the color. Turn the soil as you add water. Measure the fertilizer and limestone using an accurate scale and mix them together in a bucket. Add some of the fertilizer/limestone mix and turn the soil, repeat until all the fertilizer/limestone mix is uniformly blended.

### Watering

Miswatering, typically overwatering, is probably one of the major causes of failure with plants in a greenhouse. Despite all that has been written, watering plants comes down to two critical decisions: when to water and how much to apply at a time. How much water to apply at a time is relatively easy as long as plants are growing in

**Table 1.** Three Soilless Potting Soils for Hobby Greenhouse Culture

Type	Ingredient	per 1 cu. yd.	per 4 cu. ft.
High moisture	Peat moss (50 percent)	13½ cu.ft.	2 cu.ft.
	Vermiculite (50 percent)*	13½ cu.ft.	2 cu.ft.
High drainage Intermediate	<b>OR</b>		
	Perlite (50 percent) <b>OR</b>	13½ cu.ft.	2 cu.ft.
	Vermiculite (25 percent) * + Perlite (25 percent)	6: cu.ft. each	1 cu.ft. each
	Dolomitic limestone (ground)	8 to 10 lb.	19 to 24 oz.
	Superphosphate (0-20-0)	2 lb.	5 oz.
	Potassium nitrate (13-0-45)	1 lb.	2½ oz.
	Minor elements (manufacturer recommendations)		

\*Medium or coarse grade

well-drained potting soil. Apply an amount of water that will saturate the entire soil volume in the container plus enough for a small amount to run out the drainage hole in the bottom of the pot.

The decision of how often to water should not be based on habit, nor should watering simply be done at certain time intervals. Always check plants to determine if they require water. One advantage to a soil containing peat moss is that it changes from dark brown when wet to light tan in color when dry. This color change can be used to determine when to water. Likewise, soil containing peat moss changes from heavy when wet to much lighter in weight when dry. With practice and experience, lifting pots periodically can help you determine when it is time to water. This method is especially useful for hanging baskets. Sticking your finger into the soil about a half-inch to feel for moisture can also be used. Many plants develop a gray-green cast to the foliage when dry. This can be used to judge when to water. The goal, however, is to water before plants wilt. Wilting damages plants, often causing lower leaf loss, stunted growth and delayed flowering.

Hand watering is probably the most common watering method used in hobby greenhouses. Hand watering should be done early in the morning so that water on the foliage dries before nightfall. A watering can with a water breaker fitting is useful for watering dry spots or an occasional water-hungry plant but for larger jobs, a hose will be needed. The hose usually has a thumb valve to control water flow, a water wand to extend reach (usually a 2-foot wand is sufficient) and a water breaker nozzle (2¼-inch diameter has wide application) at the

end to soften the flow water impacting the soil surface. A one-half gallon per minute mist nozzle is also handy for watering seedlings.

When watering, go through the greenhouse systematically so that plants are not missed. Apply water gently so that the soil does not puddle, wash excessively, or knock-over young seedlings. This may require repeated light applications, especially to flats. When done, wind the hose close to the faucet so it is not under foot and hang the watering wand and breaker up off the floor to prevent the spread of diseases. Hoses last longer if the water is turned off at the faucet and the hose is drained after use.

### **Fertilizer**

Fertilizer requirements for plant growth can be classified into two groups according to the amount used by plants. The macronutrients nitrogen, phosphorus, potassium, calcium, magnesium and sulfur are needed in relatively large quantities while the micronutrients iron, manganese, boron, zinc, molybdenum, copper, and chlorine are needed in very small amounts. Calcium, magnesium, and sulfur are generally supplied by adding dolomitic limestone and superphosphate to the potting soil at the time of mixing. Adding micronutrients at the time of mixing supplies plant needs for these nutrients for three to four months.

The macronutrients nitrogen, phosphorus, and potassium are highly soluble and wash from the potting soil easily. Therefore, they must be applied frequently, often in liquid form. There is a wide range of water soluble fertilizers available in garden centers and mass market outlets, but all will provide the percentage of nitrogen, phosphorus, and potassium (example: 20-20-20 is percent N-percent P-percent K)

on the front label. When shopping for a fertilizer, purchase a water soluble, general plant fertilizer with the three percentages either very close or identical in value. Generally, it is more cost effective to purchase the highest analysis available (highest value for N-P-K).

Water soluble fertilizers can be applied by mixing a measured amount of fertilizer, according to the product label, with water in a watering can and drenching the potting soil. However, this method can become a time-consuming task if you have a large number of plants. A simple fertilizer injector that delivers fertilizer into the water line can be purchased from garden centers and mass market outlets. Common brands are Siphon, Siphonex, and Hozon. These units attach between the faucet and hose and have a siphon tube that is placed in a bucket filled with concentrated fertilizer solution. The concentrated solution is drawn into the hose, diluted in water, and delivered to plants during the normal watering operation. Follow the manufacturer's directions for mixing the concentrated fertilizer solution.

How often to apply liquid fertilizer depends on the growing environment, the plant type, and how rapidly the plant is growing. Plants in high light and temperature during late spring, summer, and early fall can be fertilized about once a week, especially annual flowers, flowering potted plants, and vegetables. Medium growth rate plants and plants in moderate light and temperature during early spring and late fall can be fertilized about once every two weeks. Slow growing plants and plants under shade can be fertilized about once a month. Many plants that stop growing in the winter should not

be fertilized until growth resumes in the spring.

### **Propagation**

Every hobby greenhouse owner either already has an interest in propagating plants or will soon develop one; there is something fascinating about becoming involved in starting a new life. Besides always purchasing established plants to meet your needs can be expensive.

### **Seed Germination**

Start with good quality, fresh seed of known parentage. Seed collected from the wild or from the neighbor's yard often does not produce plants like the original. For flowering annuals and vegetables, purchase named varieties from reputable sources. Mail order sources and reputable garden centers are the best sources because they often carry the best varieties adapted to your area and they turn over their inventories fast enough so the seed are not too old. Stay away from bargain basement seed sales.

There are many different types of containers for germinating seed. They include plastic pots, paper pots, peat pots, peat blocks, multi-cell trays, and open flats. The container to choose depends on seed size. Large seed probably perform best sown individually in pots; medium and small seed perform best sown in multi-cell trays; and very small seed perform best sown in rows in open flats. Seedlings in open flats will require transplanting soon after germination. The containers should be filled with a potting soil designed for seed germination. Generally, seedling mixes are finer textured than general potting soils so they can accommodate small seed. Seedling mixes can be purchased from garden centers and mass market outlets.

Seed should be sown in moist, but not wet seedling mix. In the process of sowing, do not place seed too close together or competition for space will result in spindly, weak seedlings. Resist the temptation to sow more seed than you really need. Follow the directions on the seed package for seed spacing and sowing depth. Large seed are placed in holes dibbled in the soil—a good rule is to make the hole no deeper than twice the diameter of the seed. Small seed are often sown directly on the soil surface and covered by sifting a small amount of fine vermiculite (fine or super fine grade) or seedling mix over the seed. A good way to water sown containers without washing the seed out of place is to submerge the container in a shallow pan of water so moisture can be absorbed by the soil through the drainage holes. Be sure to label the containers to identify what was sown. Store leftover seed sealed in labeled zip-lock plastic bags placed in the vegetable keeper of a refrigerator for future use. Note any instruction on the seed package for how long seed will remain viable under storage conditions.

Seed require a warm, moist environment to germinate. Tenting is an easy way to provide high humidity during germination and to prevent seed from drying out. On a small scale, slip the sown containers in a plastic bag (large zip-lock bags work well) and seal the open end. On a larger scale, construct a tent over a greenhouse bench from plastic pipe and clear sheet plastic. Do not expose the tents to direct sunlight. A piece of 40 to 60 percent shade fabric or cheesecloth can be used to shade the tents.

Germination temperatures vary greatly depending on the plant species, but a soil tempera-

ture of 70 to 80 degrees F works well for many seeds. Check the seed package for temperature information. Soil temperature can be monitored with a soil thermometer, which you can purchase from greenhouse supply company. Placing sown containers on an electric germinating mat (soil warming mat designed for propagation) that can be purchased from greenhouse supply companies can accelerate seed germination. Remove the tents as soon as the majority of the seedling unfold cotyledon leaves and place them at growing light intensity. Seedlings should be transplanted to larger containers before they begin to crowd, especially those sown in open flats. Seedlings with one or two mature leaves survive transplanting better than older seedlings, so do not delay transplanting!

### **Rooting Cuttings**

Growing plants from cuttings involves removing a plant part and placing it under conditions that favor development of a new root system. This is a form of cloning, often called vegetative propagation, because the new plant will be genetically identical to the parent plant. Vegetative propagation is often less expensive and faster than starting plants from seed.

Many plants are easy to root from cuttings. Some can be rooted directly in a glass of water placed in a bright window that does not get direct sun. In general, herbaceous annuals and perennials and tropical foliage plants are easier to root than woody trees and shrubs. Select a healthy disease- and insect-free parent plant, preferably one that does not have flowers. With a sharp knife, remove a 3- to 5-inch cutting from a stem tip of the parent plant. This type of cutting is called a terminal cutting. If the cutting has flowers or flower

buds, remove them. Trim the larger leaves from the lower end of the cutting so that three to four smaller leaves remain toward the cutting tip. Dip the cut end of the cutting into a rooting powder (purchase from garden center or greenhouse supply company) and tap off the surplus. Rooting powders come in different formulations for different types of plants so select a formulation based on the plant type being propagated. Removing portions of the stem below the shoot tip of the parent plant can also make subterminal cuttings. However, cuttings taken from too low on the stem may be too woody and root slowly, if at all.

Cuttings can be started in any of the containers discussed for seed germination. Generally, a coarse, well-drained potting soil such as the 50 percent peat moss and 50 percent perlite mix outlined in Table 1 promotes rapid rooting. Poke a hole in the soil and insert the cut end of the cutting into the soil up to the lowest leaves. Do not stick the cuttings all the way to the bottom of the container. Stick them just deep enough to stand up. Water the cutting immediately. During this process, do not allow the cuttings to wilt. If cuttings must be transported or sticking the cuttings must be delayed, seal them in a plastic bag with wet paper towels, place them in a cooler or refrigerator and protect them from high light.

Because cuttings do not initially have roots, they must have a high humidity environment to prevent desiccation until roots form. If a few cuttings are stuck in a pot, cover the pot with a clear plastic bag, seal the bag with a rubber band and place the pot in bright, but not direct light. On a larger scale, construct a tent over the cutting containers on a greenhouse bench from plastic pipe and clear sheet plastic as discussed for seed germi-

nation. Cuttings may require from 2 weeks to 6 months to root depending on the species and plant type, so be patient.

Another method for rooting cuttings that is used by serious hobby greenhouse owners, especially for cuttings of woody shrubs and trees, is intermittent mist propagation (Figure 1). During propagation, a film of water is maintained on the leaves by applying a fine mist from mist nozzles attached to a plastic water line installed above the bench. A day/nighttime clock turns the system on early in the morning and off late in the evening. A cyclic timer activates an electric solenoid valve in the water line to turn the mist on for a preset time, typically five seconds, and then off for a preset time, typically 5 to 10 minutes. The key to successful rooting is to set the off time so the leaves are constantly wet without excess water soaking the soil. Therefore, the off-time interval must be adjusted for changing conditions, a longer time during cloudy weather or a shorter time during sunny weather.

Greenhouse growing, like gardening, is both an art and a science. Many of the ideas presented here are practice applica-

tions of the science of how to grow plants. However, the artistic side of a hobby greenhouse is to choose plants that look and grow well and that please the owner. Choose a reasonable variety of plants and then arrange the plants and the interior space in a way that is pleasing, comfortable, and functional for all who visit.

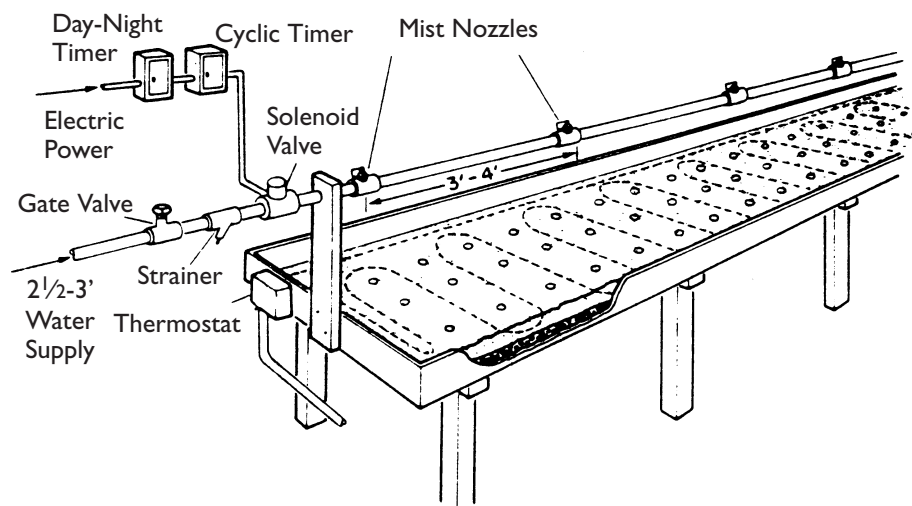
## Additional Reading

American Horticultural Society. 1982. *Gardening under Glass and Lights*. The Franklin Library/Ortho Books, Franklin Center, Pennsylvania.

D.G. Hessayon. 1997. *The Greenhouse Expert*. Sterling Publishing Company, New York, New York.

Shane Smith. 1992. *Greenhouse Gardener's Companion: Growing Food & Flowers in Your Greenhouse or Sunspace*. Fulcrum Publishing, Golden, Colorado.

Ian G. Walls. 1996. *The Complete Book of the Greenhouse*. Sterling Publishing Company, New York, New York.



**Figure 1.** Design for an intermittent mist propagation system



**ANR-1153**

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