

Chapter 13

Houseplants

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Learning Objectives

1. Explain how to use a dichotomous key by recognizing different morphological characteristics to identify woody ornamentals
2. Select the best woody ornamentals for a landscape based on site, use and plant characteristics
3. Describe the steps in transplanting a woody ornamental
4. Demonstrate the proper way and times to prune woody ornamentals
5. Identify a stressed tree and the various site problems for urban trees

Houseplants

Indoor plants increase productivity and improve positive attitudes in the work environment. The human connection to plants is natural and instinctive. People perceive that they are healthier in an environment with plants. Plants add design elements to a space and provide certain cultural requirements. The hundreds of plants commonly grown in the foliage industry exemplify the usefulness of indoor plants. Although humans benefit from indoor plants, in most cases, indoor plants do not benefit from the indoor environment. Homes and offices are poorly suited to the needs of plants. Therefore, the focus of this chapter is to provide insight on selecting and caring for plants that can best withstand a specific indoor location. To aide with this task, this chapter closes with a list, organized in alphabetical order by botanical name, of plants used indoors.

Selecting a Plant

When selecting any plant, it is important to inspect it thoroughly. Leaf surfaces and the leaf axils should be checked for signs of insects or diseases. Insect droppings, which are shiny, sticky and often located on the upper leaf surface, will sometimes be more visible than the insect pest. Besides being free of insects and diseases, plants should look sturdy, clean, well potted and shapely. Plants should also have healthy foliage. Plants with chlorotic, torn, wilted or discolored leaves should be discarded.

Plants with brown leaf margins, discolored areas or spindly growth should also be discarded. In addition, plants that have been treated with “leaf shines” should be avoided. Leaf shines add an unnatural polish to the leaves.

When selecting a flowering potted plant, the condition of the flowers should be checked. Plants should be marketed before pollen shows. Generally, with flowering potted plants, the one with flower buds about half open should be selected. However, some plants, such as potted bulbs and hibiscus, should be in bud. This is because hibiscus flowers only last one day. Finally, once the plant is purchased, it should be isolated before introducing it into the home or office. This will allow the identification and elimination of a pest problem before other plants are exposed.

Environmental Conditions for the Indoor Plant

It is easier to purchase a plant that requires the same environmental conditions of the residence or office than to alter the environment of the home or office to suit the plant's needs.

Transporting Plants

When transporting plants, there are two seasons of the year that can cause the most damage, the hot summer and the cold winter. In the summer, a plant can be damaged either by the air conditioning in the car, the heat in an unattended, parked car and/or by the direct sunlight on foliage. Therefore, when transporting plants in the summer, it is critical to provide shade from direct sun and to protect the plant from air conditioning and excessive, stagnant heat.

In the winter, plants should be wrapped thoroughly in newspaper or paper bags before leaving the store. Once wrapped, plants should be carried directly to a heated vehicle. If shopping at several stores, plant purchases should be last so the plants are not left in an unheated car. Additionally, plants should never be trans-

Figure 1. Select Healthy Plants

Select healthy plants: Plants that have new flower buds along with young foliage are usually of superior quality.



ported in the trunk during the winter months. This is because most car trunks are too cold to safely carry plants. Most plants sold for use in the home are from tropical or sub-tropical regions of the world. Thus, a short run from the store to the car in very low temperatures can severely damage plants. The same run done in near freezing or freezing temperatures can kill them.

Transporting Plants in the Cold

Many foliage plants will be damaged considerable if the temperature drops much below 50 F for a few hours, so maintain as warm a temperature as possible around these plants when transporting them from one location to another.

Acclimatization

Research conducted in Florida in the late 1970s revealed an interesting phenomenon. Plants grown in full sun have leaves known as sun leaves. These leaves are structurally different from the leaves of plants grown in shade, or shade leaves. Generally, sun leaves have fewer chloroplasts and less chlorophyll. Also, chloroplasts in sun leaves are located deep inside the leaves and the leaves are thick, small and large in number. In contrast, shade leaves have a greater number of chloroplasts

and more chlorophyll. They are also thin, large and few in number. When plants are grown in strong light, they develop sun leaves that are photosynthetically inefficient. However, if these same plants are placed in low light, the sun leaves drop from the plant and the new growth will have shade leaves that are photosynthetically more efficient.

Once a leaf is formed, its physical characteristics cannot change, meaning a sun leaf cannot become a shade leaf. Therefore, to reduce the shock that occurs when a plant with sun leaves is placed in the shade, the light levels should be gradually reduced. This will cause the more efficient shade leaves to slowly replace the inefficient sun leaves. This process should be reversed when placing plants outdoors in the summer. Newly purchased plants grown in high light conditions should be acclimatized by initially locating them in a high light area of the home or office and then gradually moving them to their permanent, darker location over a period of 4 to 8 weeks. Fortunately, the producer often acclimatizes most interior plants that are sold in retail outlets.

Environmental Factors

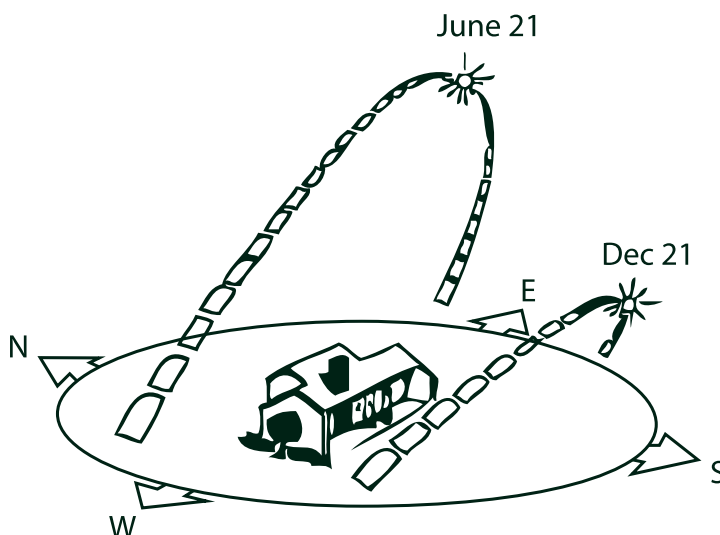
Light, water, temperature, humidity, ventilation, fertilization and soil are the chief factors affecting plant growth. If any one of these factors is out of balance, it will prevent the plant from growing properly indoors.

Light

Light is probably the most essential factor for indoor plant growth, and it is generally the most limiting factor. Both the growth of plants and the length of time they remain healthy depend upon the amount of light received. Light is necessary for all plants because it is the energy source used during photosynthesis to produce carbohydrates. When examining light levels for interior plants, three aspects of light need to be considered: intensity, duration and quality.

Light intensity influences the manufacture of plant food, stem length, leaf color and flowering. For example, a geranium grown in low light tends to be spindly with light green leaves and few, if any, flowers. In contrast, a similar plant grown in very bright light would likely be shorter, better branched and have larger, darker green leaves.

Figure 2. The Sun's Path Across the Horizon



Light Illumination

Light illumination is measured in units of foot-candles. One foot-candle is equal to one candle at a distance of one foot, which is equivalent to one lumen per square foot or 10.764 lux. For a point of reference, full sunlight outdoors during the summer is approximately 10,000 foot-candles. Building codes in many states require a minimum of 60 foot-candles of light at desktop in classrooms.

Plants used in the interiorscape can be classified according to their light needs by high, medium and low light requirements. Interior light levels can be defined as:

- **Very high light:** Bright sunlight. Few interior plants require very high light. A minimum of 1,000 foot-candles is required.
- **High light:** Bright, indirect sunlight. A person can read without supplemental lighting for most of the day. A minimum of 200 foot-candles, with 500 to 1,000 foot-candles is preferred.
- **Medium light:** Indirect sunlight. Supplemental light is needed during the early morning or evening hours in order to read. A minimum of 75 to 100 foot-candles, with 200 to 500 foot-candles is preferred.
- **Low light:** Low sunlight. Supplemental light is needed at any time of the day in order to read. A minimum of 50 foot-candles, with 75 to 200 foot-candles is preferred.

Table 1. Conversion from Shutter Speed to Foot-Candles

2.8 Shutter Speed	5.6 Shutter Speed	Approximate Foot-Candles
2	–	5
1	–	20
–	2	45
1/4	1	80
1/8	–	110
1/15	1/4	150
1/30	1/8	260
1/60	1/15	590
1/125	1/30	1000
1/250	1/60	2000
–	1/125	4000

Method for Measuring Light Intensity

A photographic light meter can be used to measure light intensity. This can be done by putting the camera light meter at an ASA setting of 25 and directing the meter or camera lens straight down to the plant tops from about 12 inches above the plants. The lens opening (F-stop) should be at 2.8 or 5.6, with the meter adjusted to the proper shutter speed. The conversions in Table 1 can be used to determine approximate foot-candles.

The intensity of light a plant receives indoors depends upon the nearness of the light source to the plant. The light intensity decreases rapidly as the distance from the source of light increases. The direction the windows in a home face also affect the intensity of natural sunlight that plants receive. Southern exposures have the most intense light, eastern and western exposures receive about 60 percent of the intensity of southern exposures, and northern exposures receive about 20 percent of a southern exposure. A southern exposure is the warmest, eastern and western are less warm and a northern exposure is the coolest. Other factors which can influence the intensity of light penetrating a window are: the type of glass and glass coatings, the window treatments, the presence of trees outside the window, the weather, the season, the shade from other buildings, and the cleanliness of the window. Reflective or light-colored surfaces inside the home or office will increase the availability of light to plants. Conversely, dark surfaces will decrease the availability of light due to absorption. Thus, it is important to be aware of the surfaces around the plant and to remember that excessive light is as harmful as is too low light.

Plants are the best indicators as to whether or not they are located in an appropriate exposure. In an excessively low light situation,

Purchasing Light Meters

If the gardener is serious about growing plants indoors, there are several inexpensive light meters available and easily located on the Internet; start the search on "light meters for plants."

poor, spindly and weak growth will result. Also, plants that normally flower indoors will not do so and leaves will drop. In contrast, in a situation where the plant gets too much direct light, the leaves may wilt, become pale, sometimes burn or bleach, turn brown and die. If a plant is under adequate light conditions, it will produce new leaves that are of similar size to those on the plant when it was purchased. The leaves will remain green and, if it is a flowering plant, it will produce flowers.

Low light intensity can be compensated by increasing the duration the plant is exposed to light, as long as the plant is not sensitive to day length in its flowering response. Increased hours of lighting allow the plant to make sufficient food to survive and/or grow. However, some plants require a period of darkness to develop properly. These plants should be illuminated for no more than 16 hours.

Day Length

Although most flowering plants are indifferent to day length, it is of importance to some plants. Poinsettia, kalanchoe and Christmas cactus set buds and flower only when day length is short, approximately 12 hours of daylight or less.

Table. 2. Media Moisture Categories

Mositure	Description
Dry	Allow soil to dry between waterings. Soils should not form a ball when compressed; soil should be crumbly when worked between fingers. Media should not be saturated when watering.
Moist	Soil mass should remain uniformly moist, but not saturated or wet. Media should form a ball when compressed, but little water should drip when compressed. Media can dry out to a depth of a few inches in most plants. Then, soil should be uniformly moistened when watering. Most indoor plants prefer "moist" soils.
Wet	Soils should never be allowed to dry out. Media should always form a ball when compressed. However, plants should not be in standing water.

If necessary, additional lighting may be supplied by either incandescent or fluorescent light. If artificial lights are used as the only source of light for growing plants, the quality of light (wavelength) must be considered. For photosynthesis, plants require mostly blue and red light. Incandescent lights produce mostly red and far-red light, but are very low in blue. Fluorescent lights vary according to the phosphors used by the manufacturer. Cool-white lights produce mostly blue light, and are low in red light; however, they have the advantage of being cool enough to position quite close to plants. Therefore, either a combination of warm-white and cool-white fluorescent tubes or incandescent lights with cool-white fluorescent tubes should be used. The new compact fluorescent lights open up new possibilities of using indoor lighting to improve plant growth.

Water

Over and under watering account for a large percentage of interior plant losses. The most common question gardeners ask is, "How often should I water plants?" Unfortunately, there is no good answer to this question. This is because plants are unique and their environment influences their needs.

Plant roots are usually in the bottom two-thirds of the pot. Therefore, plants should usually not be watered until the bottom two-thirds start to dry out slightly. This is assessed not by appearance, but by feel of the soil. For a 6-inch pot, fingers should be stuck in about 2 inches into the soil. If the soil feels damp, it does not need water. This test should be repeated until the soil is barely moist at the 2-inch depth. For smaller pots, 1 inch into the soil is the proper depth to measure. Many gardeners choose to judge irrigation needs based on the weight of the potted plant -the drier it is, the less it will weigh- or the color of the growing medium -the lighter the color of the growing medium, the drier the medium. It is not a good rule to teach gardeners to water as soon as the soil surface dries, as this can result in overwatering.

When it is time to water the plants, water should be added to the pot until it runs out of the bottom. This serves two purposes: it washes out all the excess salts (fertilizer residue); and it guarantees that the bottom two-thirds of the pot, which contains most of the roots, receives sufficient water. The pot should not sit

in the water that runs out. The best way to ensure thorough wetting of the growing medium is to take the plant to the sink and let the water drain through the pot.

Water quality is another consideration. Water that has run through a water softener is high in sodium and should not be used to water interior plants. Chlorine used for water treatment is readily dissipated when the water is aerated. Fluorine, added to many municipal water systems for dental hygiene, can cause foliar leaf spots on many plants, see Table 3 below. Unfortunately, there is no easy way to remove it from the water. Therefore, plants sensitive to fluorine should be watered with either rain or distilled water. The pH of the growing medium should be kept above 6.0, because fluorine will then be chemically bound and unavailable to the plant.

Temperature

Most interior plants tolerate normal temperature fluctuations. In general, most plants grow best between 70 and 80 degrees F during the day and from 60 to 68 degrees F at night. Flowering interior plants are slightly different, they prefer the same daytime range, but do best at night temperatures from 55 to 60 degrees F. The lower night temperatures induce physiological recovery from moisture loss, intensifies flower color and prolongs flower life. Excessively low or high temperatures may stop growth, cause plant failures, cause spindly growth, or cause foliage and flower damage or drop. A good rule of thumb is to keep the night temperature 10 to 15 degrees lower than

the day temperature. If the temperature is comfortable to the homeowner, chances are that the temperature is fine for most plants.

Humidity

Atmospheric humidity is expressed as a percentage of the moisture saturation of air. Central heating and air conditioning systems tend to remove moisture from the air. Some plants such as orchids, maidenhair ferns, marantas, calatheas and carnivorous plants will not grow well under low humidity conditions. To provide increased humidity, a humidifier can be attached to the heating or ventilating system in the home. Alternatively, gravel trays, with even water levels, can be placed under the plant containers. Gravel trays will increase the relative humidity in the vicinity of the containers. As the moisture around the pebbles evaporates, the relative humidity is raised. Another way to raise humidity is to group plants close together. Spraying a fine mist on the foliage can also increase humidity, but this has only a short-term effect and is of doubtful effectiveness for prolonged total humidity modification. If misting is done, it should be done early in the day so the plants will be dry by night. This lessens the chance of disease, since cool dampness at night provides an ideal environment for disease infection.

Ventilation

Interior plants are very sensitive to drafts or heat from registers. Forced air dries the plant rapidly, overtaxes their limited root systems and may cause damage or plant loss. Plants are sensitive to natural gas. Some plants will not flower, while others drop flower buds and foliage when exposed to gases. Tomato plants and China doll (*Radermachera sinica*) are extremely sensitive to gas. Their leaves turn yellow and, in extreme cases, drop before the escaping gas is detected by household members. These plants are sometimes used in greenhouses as indicators for excessive ethylene gas and carbon monoxide. If gases are suspected of leaking into the home, a heating service company or utility supplier should be contacted immediately.

Table 3. Fluoride Sensitive Plants

Species	Common Name	Family
<i>Calathea spp.</i>	Many species	Marantaceae
<i>Chamaedorea elegans</i>	Parlor Palm	Palmae
<i>Chlorophytum comosum</i>	Spider Plant	Liliaceae
<i>Cordyline terminalis</i>	Good Luck Plant	Agavaceae
<i>Ctenanthe oppenheimiana</i>	Never-Never Plant	Marantaceae
<i>Dracaena spp.</i>	Many species	Agavaceae
<i>Gibasis pellucida</i>	Tahitian Bridal Veil	Commelinaceae
<i>Lilium spp.</i>	Many species	Liliaceae
<i>Maranta leuconeura</i>	Prayer Plant	Marantaceae
<i>Spathiphyllum spp.</i>	Peace lily and others	Araceae
<i>Yucca spp.</i>	Many species	Agavaceae

Fertilization

Interior plants, like most other plants, need fertilizers containing three major plant food elements: nitrogen, phosphorus and potassium. These elements are available in many different combinations and under a multitude of brand names. Each product will have the analysis printed on the label, indicating specifically how much water-soluble elemental nitrogen, phosphate or potash is available in every pound of the product. Commercial fertilizers used for interior plants are sold in granular, crystalline, liquid, tablet, spike or encapsulated-pellet forms. Each should be used according to instructions on the package label. Frequency of fertilizer application varies somewhat with the vigor of growth and age of each plant, environmental conditions and type of fertilizer product.

As a general rule, plants should be fertilized every 2 weeks from March until September. During the winter months, reduced or no fertilizer is needed because reduced light and temperature result in reduced growth. Fertilizing at this time could be detrimental to some plants. Crystalline or liquid fertilizers dissolved in water may be used every 2 weeks and tablets, spikes, encapsulated-pellets and granular fertilizers are designed to last approximately 60 days or longer.

For a thorough discussion of plant nutrition, see Chapter 3, Soils and Plant Nutrition.

Soluble Salts

Soluble salts, or dissolved minerals, naturally occur in water. Fertilizer dissolved in water is an additional source of soluble salts. Salts can accumulate on top of the growing medium, forming a yellow to white crust. A ring of salt deposits may form around the pot rim, at the growing medium line or around the drainage hole. Salts will also build up on the outside of clay pots.

Excessive water and fertilization can contribute to a buildup of soluble salts in the growing medium. When water evaporates from the growing medium, the minerals or salts stay behind. As the salts in the growing medium become more and more concentrated, plants find it more difficult to take up water. If salts build to an extremely high level, water can be lost from roots, causing them to die. As root tips die, plants lose the ability to absorb water. Leaf tips will develop brown, necrotic

or dead spots. High-soluble salts damage the roots directly, and because the plant is weakened, it is more susceptible to attack from insects and diseases. One of the most common problems associated with high salts levels is root rot.

The best way to prevent soluble salts injury is to stop the salts from building up. This is done by watering correctly and not over fertilizing. Plants should be watered until water flows through the pot to an amount either equal to or 10 percent of the volume of the pot. As stated earlier, the pot should never sit in the water that has flowed through it. If the pot sits in the drained water, the water will be reabsorbed into the growing medium through the drainage hole or directly through the clay pot. Thus, the salts that were washed out will be taken back into the growing medium.

In addition to fertilizing and watering appropriately, leaching the growing medium every few months will decrease salt buildup. Pouring a lot of water on the growing medium and letting it drain completely will accomplish leaching. The amount of water used for leaching should equal twice the volume of the pot. Thus, a 6-inch pot will hold 10 cups of water, so 20 cups of water are needed to leach a plant in a 6-inch pot. When leaching, the water should be kept running through the growing medium to wash the salts out. If a layer of salts has formed a crust on top of the growing medium, the salt crust should be removed before leaching. However, no more than 1/4 inch of growing medium should be removed. It is best not to add more growing medium to the top of the pot. If the soluble salts level is extremely high or the pot has no drainage, the plant will need to be repotted.

The level of salts that will cause injury varies with the type and age of the plant and how it is being grown. That being said, in general, salts at concentrations of 200 ppm may injure a plant grown in the home. Some nurseries and plant shops leach plants to remove excess salts before the plant is sold. However, since this information may not be known, it is best to leach a newly purchased plant the first time it is watered.

Signs of Salt Injury

Reduced growth, brown leaf tips, dropping of lower leaves, small new growth, dead root tips and wilting are all signs of high-soluble salts.

Growing Media

The potting or growing media in which a plant grows provides a reservoir for holding water and nutrients, physical support for plant growth and oxygen for root respiration and health. Most plants produced for use in the interior environment are grown in soilless growing media. There are numerous different blends of soilless growing media available to the commercial producer and on the retail market. Most contain several common components blended in various proportions: sphagnum peat moss, vermiculite, perlite, pine bark, composted hardwood barks and coarse sand.

Growing Media for Cacti, Succulents, Bromeliads and Orchids

Specialty mixes are available on the retail market for cacti, succulents, bromeliads and orchids. For most terrestrial cacti and succulents, these growing media contain a higher proportion of coarse sand. It is important that the media is well drained to prevent the possibility of root or crown rot. Epiphytic cacti-plants that are found in their native habitats growing in the canopy of other plants or on other objects- such as the Christmas cactus and the orchid cactus require growing media with greater organic matter than for the terrestrial cacti and succulents. Most orchids are grown in fir-bark or Osmunda fibers often blended with activated charcoal. Orchids require greater aeration than most plants used in the interior environment. Bromeliads require a coarse growing medium high in organic matter. Just like the cacti, there are terrestrial and epiphytic forms of bromeliads. Many treat the epiphytic bromeliads as orchids when selecting growing media. The terrestrial forms are grown in the commonly used growing media used for most other interior plants.

Containers

Choosing a Container

Some containers are better used as decorative containers rather than growing containers. Decorative containers usually do not have a hole for water drainage or, if they have a hole, it is not large enough for proper drainage. These containers are made of a variety of aesthetically pleasing materials and are used to hold the plant and its growing container. The term used to describe a container in a container is called "double-potting." Double potting is a popular practice in the interior plantscaping industry and allows for easy care and replacement of interior plants. When selecting decorative containers, care should be taken to select one that is slightly wider and taller than the growing container. That way, the growing container is totally hidden and the aesthetic look of the decorative container is not hindered. A plastic saucer should be placed in the bottom of the decorative container to prevent water drainage from the growing container to damage the decorative container, especially if it is made of wicker, brass or copper.

There are many types of growing containers from which to choose. A good growing container should provide bottom drainage, be large enough to provide room for soil and roots, and have sufficient headroom-space between the top of the pot and the soil line for proper watering. Good growing containers may be ceramic, plastic, fiberglass, wood, aluminum or another type of material.

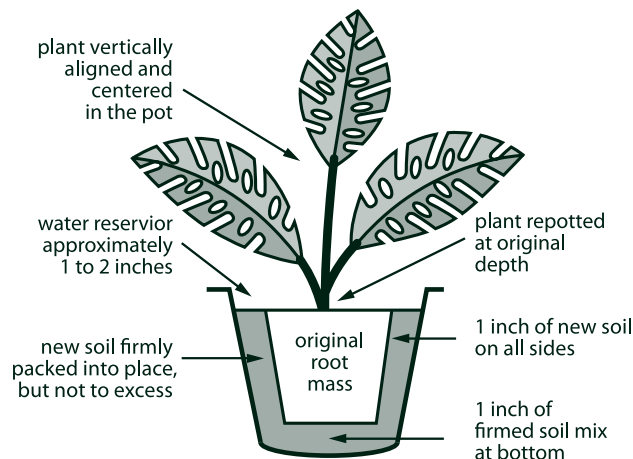
Types of Containers

Unglazed and glazed porous clay pots with drainage holes are widely used as indoor plant containers. Although they are easily broken, clay pots provide excellent aeration for plant roots and are considered to be the healthiest type of container for a plant. Clay pots absorb and lose moisture through their walls. Therefore, moisture and nutrients accumulate in the clay pores and the greatest level of oxygen is found at the pot-growing medium interface. Thus, it is not a surprise that frequently, the greatest accumulation of roots is next to the walls of the clay pot.

Ceramic pots are usually glazed on the outside and sometimes on the inside. They are frequently designed without drainage holes

Figure 3.

Watertight Container that Collects Water in the Bottom



and should be avoided as growing containers. Small novelty containers have little room for soil and roots and are largely ornamental. It should be noted that placing clay pot chips or shards of gravel in the bottom of a pot does not improve soil drainage; this only provides a small space beneath the soil where some excess water can drain inside the pot.

Plastic and fiberglass containers are usually quite light and easy to handle. They have become popular in recent years because they are relatively inexpensive and often quite attractive in shape and color. Plastic pots are easy to sterilize or clean for reuse, and because they are not porous, they need less frequent watering and tend to accumulate fewer salts.

Terrariums

Terrariums are miniature landscapes in any type of clear container. Terrarium containers can be plastic or glass, recycled or new. Terrariums should never be placed in direct sunlight. It is important to select plants with similar light, moisture, temperature and humidity requirements for each terrarium.

Figure 4. Terrarium



Creating a Terrarium

1. The bottom layer should be about an inch or more of course material. Pea gravel, pebble, marbles or course sand can be used. This layer allows a reservoir for excess water that helps protect plants from becoming too wet and susceptible to root-rot.
2. The next layer should consist of activated charcoal, similar to what is used in an aquarium filter. This layer cleans the air of the gasses and fumes that result from decomposing organic materials.
3. The third layer should consist of a thin cover of whole, not shredded, sphagnum moss spread evenly over the first two layers. The moss prevents the soil from settling down into the drainage layer.
4. The final level is the soil media. Potting mix and course sand provide structure for root support and nutrients for the plants. If the intent is to create a 'desert garden,' extra sand should be added to the soil mixture and additional gravel to the drainage level.

Repotting

Actively growing plants need repotting from time to time. Indications that plants require repotting include roots fill the pot and are growing out of the drainage hole, the bottom or the sides of the pot; the plant requires frequent watering; or the scale of plant and container is out of proportion.

When repotting becomes necessary, it should be done without delay. The pot selected for repotting should be no more than 2 inches larger in diameter than the pot the plant is currently growing in, should have at least one drainage hole, may be made of any material and be clean. Soluble salts should be washed from clay pots with a solution of equal parts water and vinegar. The pot should be allowed to soak about 30 minutes before scrubbing with a stiff brush. Then, the pot should be rinsed in fresh water until the vinegar odor is gone. All pots should be soaked in a solution of one part liquid bleach to nine parts water for about 30 to 60 minutes. This will destroy any fungal spores and bacteria. Then, pots should be rinsed with water until the bleach odor is gone.

Most plants are easily removed from their pot if the pot is held upside-down while knocking the lip of the container sharply upon the edge of a table. To do this, a hand should be held over the growing media, straddling

the plant between the fore and middle fingers while knocking it out of its present container.

Growing media should be moistened before repotting begins. If the plant has become root-bound, it will be necessary to cut and unwind any roots that circle the plant; otherwise the roots will never develop normally. The bottom ½ -inch of the rootball should be trimmed off and the sides should be scored. If the old growing medium surface has accumulated salts, the top inch should be removed. This root pruning will not harm the plant, but will stimulate new root growth and encourage better establishment in the new container.

Enough growing medium should be added to the bottom of the container so the plant will be at the same depth as in the old container. The rootball should be set in the middle of the new medium and the sides between the rootball and pot should be filled with growing medium. Growing medium should not be added above the original level on the rootball unless the roots are exposed or it has been necessary to remove some of the surface growing medium. The growing medium should not be packed firm; to firm or settle it, the pot should be tapped on a level surface or gently pressed with fingers. Excessive force should be avoided in order to prevent compacting the media. If compacted, there will be reduced drainage and aeration.

After watering and settling, the growing medium level should be sufficiently below the rim of the pot to leave headroom. A properly potted plant has enough headroom to allow water to wash through the growing medium and thoroughly moisten it.

Training and Grooming

Training and grooming includes a number of activities that can distinguish the beginner from the more experienced gardener. Pinching, pruning and disbudding are done to improve or maintain the shape and size of plants. Pinching is the removal of one inch or less of new stem and leaf growth, just above a node. This stimulates new growth and maintains attractiveness. It can be a one-time or a continuous activity, depending on the type of plant and the needs and the desires of the plant owner. To keep a plant compact, but well-filled out, frequent pinching is necessary.

Pruning is a similar activity. However, pruning includes removal of more than termi-

Figure 5. Repotting Houseplants



A. Repot when roots are growing out of the drainage hole. Hold the pot upside-down while removing the plant. Trim excess roots.

B. Place new soil in bottom of pot. Support the plant while adding soil to the sides.

C. Trim off any dead or broken foliage.

Figure 6. Pinch New Growth Just Above the Node



Pinch 1-inch or Less of the New Growth just Above the Node

nal shoot tips. Sometimes an entire branch or section of a plant should be removed for the sake of appearance. When the gardener disbuds, lateral flower buds are removed to grow a larger terminal flower from a few choice buds. Disbudding is also done to prevent flowering of a very young plant, recently rooted cutting or recently repotted plant.

Training is growing plants with vining-growth habits on trellises or heavy-gauge wire forms. Ivy, hoyo, philodendron and syngonium are frequently grown this way. Those plants that produce aerial roots or tendrils will naturally grow on the supports. Some plants that vine will need to be tied to the trellis or frame of the form.

Grooming is done to keep plants clean and neat. It not only improves the appearance of plants, but also reduces the incidence of insects and disease problems. To groom a plant, all spent flowers, dying leaves and dead branches should be removed. Leaves should be kept dust free by washing them with warm water and mild soap-pots should be covered to prevent soap from entering the growing medium. If tips of leaves become brown and dry, they should be trimmed with sharp scissors. Occasionally, placing the plant in the shower or outside under the garden hose with a water breaker is good practice. This practice rinses off dust, leaches and cleans the foliage. Removal of salt deposits at the growing medium surface and replacement with clean growing medium does more for appearance than for the plant itself.

Care of Special Potted Plants

Too little light, excessive heat and improper watering are the usual causes of failure in caring for many flowering potted plants or “gift” plants such as cyclamen, potted chrysanthemums or florist’s gloxinia. These plants are grown in a greenhouse where the night temperatures are usually cool, there is ample light and the air is moist. When they are brought into a dry home where the light is poor and the temperatures are maintained for human comfort, results are frequently disappointing. Thus, a gift plant should not be expected to last from year to year. They should be enjoyed while they are attractive and in season and then discarded. To prolong the life of a gift plant, it should be placed away from drafts from heating and cooling systems.

Amaryllis

The secret of growing amaryllis is to keep the plant well fertilized and actively growing after they finish blooming. The plants should be kept in full sun, with a night temperature above 60 degrees F. As soon as danger of frost has passed, the plants should be set in the garden in a semi-shaded spot. In the fall, before danger of frost, plants should be brought in and watering should be stopped. This will allow old growth to die back. Bulbs should then be stored in a cool, dark place to rest. Plants will be ready to force again about November 1. At this time, they should be brought into a warm, lighted room and watered moderately to begin new growth.

Azaleas

Azaleas require direct sunlight to remain healthy. A night temperature of 60 degrees F will prolong bloom. The soil should constantly be kept moist. If the leaves turn yellow, the soil is not acidic enough. Azaleas need an acidic fertilizer. When repotting, a mixture high in acidic peat moss should be used. Azaleas can be planted, pot and all, in a shady spot in the garden during the summer months. They should be examined frequently and kept watered during dry periods. Softened water should not be used for azaleas. Also, greenhouse azaleas are not hardy and need to be brought indoors before freezing weather.

Azaleas need a cool rest treatment before they are forced into bloom. Therefore, the plants should be placed in a room with filtered light and a temperature between 35-50 degrees F. During this rest period, flower buds will develop. Around January 1, plants should be placed in a well-lighted, warm (65 degrees F) room to bring them into bloom. Unless the proper growing conditions are provided for the azalea, carrying the plants over should not be attempted.

Gardenia

Gardenias grown indoors need special care. They demand an acid soil and should receive the same nutritional care as azaleas. The night temperature should be near 60 degrees F and the humidity around the plant should be high. High temperature and low light intensity will result in flower bud drop. Gardenias are very susceptible to white fly and mealy bug.

Christmas Cactus

The Christmas cactus has become increasingly popular with the development of many new varieties. At least three related species are sold in addition to a number of hybrid cultivars. All have similar cultural requirements.

The secret of good bud set seems to be one of temperature and photoperiod control. Buds will develop and bloom if given bright light, short days and night temperatures between 55 and 65 degrees F. Water stress should be avoided during autumn months, as this will reduce the number of flower buds formed. Repotting is necessary only about once every 3 years. Full sunlight is beneficial in midwinter, but bright sun during summer months can make plants look pale and yellow.

Christmas cactus requires less water from October to March than they do when growth is active from April to September. After flowering between Thanksgiving and Christmas, plant growth is markedly reduced. Care should be taken not to overwater during the dark days of winter.

Cyclamen

Cyclamen require bright sunlight and a night temperature between 50 and 60 degrees F. They are heavy users of water and must be watered whenever the surface of the soil is dry. Flower buds will fail to develop if the night temperature is too high or if light is poor.

Cyclamen can be carried over, but as with the poinsettia, homegrown plants are seldom equal to those grown by a commercial grower. The plants should be allowed to die down after they finish flowering and the fleshy corm should be replanted in June with the top of the corm above the soil line. Resting bulbs should be allowed to dry, but not so much as they shrivel.

Poinsettia

The poinsettia requires bright light and should be kept away from drafts. A temperature between 65 and 70 degrees F is ideal. Temperatures below 60 degrees F and above 75 degrees F should be avoided. Plants should be well-watered but not overwatered. Some of the newer, long-lasting varieties can be kept attractive all winter.

Gardeners frequently ask whether they can carry their poinsettias over to bloom again next year. It is questionable whether the results are worth the effort, as the quality of home-grown plants seldom equals that of commercially grown plants. However, for those who wish to try, the following procedure can be followed.

After the bracts—the colorful leaves—fade or fall, the plants should be set where they will receive indirect light and temperatures around 55 to 60 degrees F. The plants should be watered sparingly during this time. There should be just enough water to keep the stems from shriveling. The plants should be cut back to within 5 inches of the ground and re-potted in fresh growing medium. As soon as new growth begins, the plants should be placed in a well-lighted window and frequently fertilized. After the danger of frost, the pots should be placed outdoors in a partially shaded spot. New growth should be pinched back to get a plant with several stems. However, plants should not be pinched after Sept. 1. After Labor Day, or as soon as the nights are cool, plants should be brought indoors. Once indoors, the plants should be allowed to continue to grow in a sunny room with a night temperature of about 65 degrees F. However, since the poinsettia blooms only during short days, artificial light should be excluded either by covering the plant with a light-proof box each evening or by placing the plant in an unlighted room or closet for a minimum of 12 hours. Plants require full light in the daytime. There-

Are Poinsettias Poisonous?

One final note about poinsettias; there is a persistent myth that poinsettias are poisonous. This is just that, a myth. Research conducted in the 1970s gave poinsettias a “clean bill of health.”

fore, during the day, they need to be returned to a sunny window. Short-day treatments should be started by mid-September to have blooms between December 1 and Christmas. See Table 4 at end of chapter.

Common Problems

Most houseplant problems are caused by unfavorable environmental conditions or sudden changes in the surroundings. Some of these changes include changing from cool or heated air, moving a plant from low or high light, over or under watering, or improper drainage. These changes can cause a plant stress, making them more susceptible to pests and diseases. The most common diseases are caused by root rot or abiotic conditions. Houseplants may also have issues with botrytis, bacterial leaf spot, crown rot and powdery mildew. Below is a list of common houseplant insect pests, diseases and symptoms. Please see Chapter 17, Pathology and Chapter 18, Entomology for more information.

Cautions

Growing houseplants can be a rewarding hobby. However, some houseplants can be toxic or poisonous if ingested or rubbed on the skin. Every person can react differently to any kind of plant. A full list of poisonous or toxic plants is listed in the Appendix of this handbook. If a pet, child or person is suspected of having a severe reaction to a houseplant, contact the local poison control or emergency room and identify the plant. If the plant cannot be identified, bring a sample with you.

Summary

Growing indoor plants can be a productive, rewarding and soothing hobby. There are many plants that can be successfully grown indoors. Hopefully, after understanding this chapter, you will be able to choose and transport healthy houseplants, properly acclimate plants without causing stress, balance indoor environmental factors, access the light via directional exposure, and properly care for potted plants.

Table 5. Common Insect Problems in Houseplants

Insect Pest	Damage
Aphids	Sticky foliage with black mold (sooty mold). New foliage may be deformed. Soft-bodied insects will be present.
Fungus gnats	Black gnats fly around the plant and lay eggs in the soil. Maggots feed on roots.
Mealybugs	Sooty mold and white fluffy clusters near the nodes and undersides of the leaves.
Mites	Webs may be present with sooty mold residue on leaves.
Scale	Brown, round and flat insects attached to the stem. Sooty mold may be present on leaves.
Symphilids/ Springtails	Leaves and roots will have been chewed on. Springtails can hop.
Thrips	Tiny silver marks on flower or tender leaves, deformed new growth.

Terms To Know

Acclimation
Epiphytic plants
Growing media
High light
Leaf axils
Low light
Medium light
Photoperiod
Pinching
Pruning
Rootball
Shade leaves
Soluble salts
Sun leaves

Test Your Knowledge

1. What are considerations one should make when choosing an houseplant?
2. What is the difference between “sun leaves” and “shade leaves”?
3. How does one use a photographic light meter to measure light intensity?
4. How do you properly water plants in a 6-inch pot?
5. What are the signs and causes excess soluble salts?

Resources

Extension Search website
eXtension.org
Missouri Botanical Garden
mobot.org
University of Nebraska Extension
lancaster.unl.edu/hort/Houseplants

Table 4. Popular Interior Plants and their Characteristics and Uses

Botanical and common names	Conditions			Plant Characteristics and Uses							
	Light	Temperature	Humidity	Table Plant	Specimen	Hanging Basket	Ground Cover	Toments & Trained	Dish Garden	Unique Foliage	Durable Plant
<i>Asparagus setaceus</i> , plumed asparagus fern	H	W	M		T	T					
<i>Aspidistra elatior</i> , cast-iron plant	L	C	L		T						T
<i>Astrophytum myrostigma</i> , bishop's cap	H	CR	L	T					T		T
<i>Beaucarnea recurvata</i> (<i>Nolina recurvata</i>), ponytail plant	M	W	L	T	T	T			T		T
<i>Begonia x argenteoguttata</i> , angel-winged begonia	H	W	M		T					T	T
<i>Begonia masoniana</i> , iron-cross begonia	M	W	M	T	T						T
<i>Begonia rex</i> , rex begonia	M	W	M	T	T						T
<i>Calathea</i> species, calathea	M	W	H	T		T	T		T	T	
<i>Callisia</i> species, Bolivian Jew	M	W	M		T						
<i>Caryota mitis</i> , fishtail palm	H	W	M		T						
<i>Cephalocereus senilis</i> , old-man cactus	H	CR	L	T	T				T		T
<i>Cereus peruvianus</i> , apple cactus	H	CR	L	T	T				T		T
<i>Chamaedorea elegans</i> , parlor palm	H	W	M		T				T		T
<i>Chlorophytum comosum</i> 'Vittatum', white-striped spider plant	M	W	H			T	T			T	
<i>Chrysalidocarpus lutescens</i> , butterfly palm, areca palm	H	W	M		T						T
<i>Cissus antacritica</i> , kangaroo vine	M	W	M			T	T				
<i>Cissus discolor</i> , begonia cissus	M	W	M			T	T			T	
<i>Cissus quadrangularis</i> , winged treebine	M	W	L			T	T				T
<i>Cissus rhombifolia</i> , grape ivy	M	W	M			T	T				
<i>Clerodendron thomsoniae</i> , glory bower	H	W	M		T	T		T			
<i>Codiaeum variegatum</i> , croton	H	W	L	T	T				T	T	
<i>Cordyline terminalis</i> , Hawaiian ti plant	M	W	M	T	T				T	T	
<i>Crassula argentea</i> , jade plant	M	W	L	T	T				T	T	T
<i>Cryptanthus acaulis</i> , earthstar	M	W	L	T					T		T
<i>Cyanotis kewensis</i> , teddy bear vine	M	W	M			T	T				
<i>Cycas revoluta</i> , sago palm	H	W	L		T						T
<i>Cyrtomium falcatum</i> , holly fern	L	W	M			T					T

Light levels: VH = direct sunlight, a person can read without supplemental lighting at any time during the day; H = bright, indirect sunlight, a person can read without supplemental lighting for most of the day; M = indirect sunlight, supplemental light needed during the early morning or early evening hours in order to read; L = low sunlight, supplemental light needed at any time of the day in order to read.

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<i>Cycas revoluta</i> , sago palm	H	W	L		T						T
<i>Cyrtomium falcatum</i> , holly fern	L	W	M			T					T
<i>Davallia</i> species, squirrel's-foot fern	M	C	H	T		T			T		
<i>Dieffenbachia</i> hybrids, dumbcane, dieffenbachia	L	W	L	T	T				T	T	T
<i>Dizgotheca elegantissima</i> , false aralia	VH	W	L		T				T	T	
<i>Dracaena deremensis</i> 'Janet Craig', Janet Craig dracaena	M	W	L	T	T				T	T	
<i>Dracaena deremensis</i> 'Warneckeii', Warnecke's dracaena	L	W	L	T	T				T	T	
<i>Dracaena fragrans</i> 'Massangeana', striped corn plant	M	W	L		T				T	T	
<i>Dracaena marginata</i> , Madagascar dragon tree, red-edged dracaena	H	W	L		T				T		
<i>Dracaena marginata</i> 'Tricolor', rainbow dracaena	VH	W	M		T				T	T	
<i>Echinocactus grusonii</i> , barrel cactus	H	CR	L	T	T				T		T
<i>Episcia</i> species and cultivars, flame violet	M	W	M	T		T			T	T	
<i>Epiphyllum</i> hybrids, orchid cactus	H	CR	M			T					
<i>Epipremnum aureum</i> , pothos	L	C	L			T	T	T		T	T
<i>Euphorbia milii</i> , crown-of-thorns	H	W	L	T	T						T
<i>Euphorbia obesa</i> , basketball plant	H	W	L	T					T		T
<i>Fatsyhedera lizei</i> , botanical wonder	M	C	M		T						T
<i>Fatsia japonica</i> , Japanese fatsia, Japanese aralia	M	C	M		T						T
<i>Faucaria tigrina</i> , tiger's jaws	H	CR	L	T					T		T
<i>Ficus benjamina</i> , weeping fig	H	W	M	T	T				T		
<i>Ficus elastica</i> , rubber plant	M	W	L		T					T	T
<i>Ficus lyrata</i> , fiddleleaf fig	L	W	L		T						T
<i>Ficus pumila</i> , creeping fig	L	W	M			T	T	T			T
<i>Fittonia verschaffeltii</i> var. <i>argyroneura</i> , white nerve plant	M	W	H	T		T	T		T	T	

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Graptopetalum paraguayense, ghost plant	M	CR	L	T		T	T		T		T
Grevillia robusta, silky oak	H	W	M		T						
Gynura aurantiaca, purple passion vine	H	W	M			T				T	
Hatiora salicornioides, drunkard's dream	M	CR	L	T		T	T		T		T
Hedera helix, English ivy	M	W	M			T	T	T	T	T	T
Hemigraphis alternata, red ivy	M	W	M	T		T	T		T	T	
Hoya cultivars, hoyo	H	W	L			T	T		T	T	T
Lithops species, living stones	H	CR	L	T					T		T
Mammillaria species, pincushion cactus	H	CR	L	T					T		T
Maranta leuconeura var. kerchoviana, prayer plant	M	W	H	T		T	T		T	T	
Maranta leuconeura var. erythroneura, red prayer plant, red nerve plant	M	W	H	T		T	T		T	T	
Monstera deliciosa, splitleaf philodendron, Mexican breadfruit	M	W	M		T			T			T
Nematanthus species, gold-fish plant	M	W	M			T					
Neoreglia species	H	W	L	T					T	T	T
Nephrolepis exaltata, sword fern	M	W	M			T					
Opuntia species, prickly pear	H	CR	L	T	T	T			T		T
Pandanus veitchii, screwpine	H	W	L		T					T	T
Pedilanthus tithymaloides, red lady slipper flower	H	W	L		T					T	T
Pellionia pulchra, rainbow vine	H	W	M	T		T	T			T	
Pellionia repens, trailing watermelon vine	H	W	M	T		T	T			T	
Peperomia argyreia, watermelon peperomia	H	W	M	T					T	T	
Peperomia caperata 'Emerald Ripple', emerald ripple peperomia	H	W	M	T					T		
Peperomia griseoargentea, ivy-leaf pepper	H	W	M	T					T	T	
Peperomia obtusifolia, pepperface, roundleaf peperomia	H	W	M	T					T	T	

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Peperomia scandens, serpent peperomia	H	W	M	T		T	T		T		
Philodendron hybrids, philodendron	M	W	L	T	T	T	T	T	T	T	T
Philodendron bipennifolium, fiddleleaf philodendron	M	W	L		T						T
Philodendron bipinnatifidum (P. Selloum), tree philodendron	M	W	L		T						T
Philodendron scandens var. oxycardium, heartleaf philodendron	M	W	L			T	T	T	T	T	T
Phoenix Roebelenii, dwarf pygmy palm	H	W	M		T						
Pilea Cadiereri, aluminum plant	M	W	M	T					T	T	
Pilea nummularifolia, creeping Charlie	M	W	M	T		T	T				
Pilea repens, black-leaf Panamiga	M	W	M	T		T				T	
Pittosporum tobira, Japanese pittosportum	VH	W	L	T	T						T
Platycerium species, staghorn fern	M	W	M	T	T	T					
Plectranthus australis, Swedish ivy	M	W	M	T		T	T			T	
Plectranthus fosteri, candle plant	M	W	M	T		T	T				
Plectranthus oertendahli 'Variegatus', coleus vine	M	W	M	T		T	T			T	
Podocarpus macrophyllus, Japanese yew	VH	W	L	T	T						T
Polyscias guilfoylei, German aralia	H	W	M		T					T	
Portulacacrai afra, elephant bush	H	W	L	T	T				T		T
Radermachera sinica, China doll	M	W	M	T	T				T		T
Rhapis cultivars, lady palm	H	W	M		T						
Rhoeo spathacea (Tradescantia spathacea), Moses-in-the-cradle	H	W	H	T		T			T	T	T
Sainpaulia ionantha, African violet	M	W	M	T					T	T	
Sansevieria cylindrica, cylindrical snakeplant	L	W	L	T	T				T	T	T
Sansevieria trifasciata, snakeplant	L	W	L	T	T				T	T	T
Sansevieria trifasciata 'Hahnii', bird's-nest sansevieria	M	W	L	T					T	T	T

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<i>Sansevieria trifasciata</i> 'Laurentii', Laurent's sansevieria	M	W	L	T	T				T	T	T
<i>Sansevieria zeylanica</i> , Ceylon bowstring hemp	M	W	L	T	T				T		T
<i>Sansevieria trifasciata</i> 'Laurentii', Laurent's sansevieria	M	W	L	T	T				T	T	T
<i>Sansevieria zeylanica</i> , Ceylon bowstring hemp	M	W	L	T	T				T		T
<i>Saxifraga stolonifera</i> , strawberry begonia	M	W	H	T		T	T		T	T	
<i>Schefflera actinophylla</i> , schefflera	H	W	M	T	T				T		T
<i>Schefflera arboricola</i> , dwarf schefflera	M	W	M	T	T				T		T
<i>Schlumbergera x buckleyi</i> (<i>S. Bridgesii</i>), Christmas cactus	M	CR	M	T		T					T
<i>Schlumbergera gaertneri</i> (<i>Hatiora gaertneri</i>), Easter cactus	M	CR	M	T		T					T
<i>Sedum morganianum</i> , burro's tail	VH	W	L			T					T
<i>Senecio herreianus</i> , green marble vine	H	W	M	T		T					
<i>Setcreasea purpurea</i> (<i>Tradescantia purpurea</i>), purple heart	H	W	M			T				T	
<i>Soleirolia soleirolii</i> , baby's-tears	M	W	H	T		T	T		T		
<i>Spathiphyllum</i> hybrids, peace lily	L	W	M	T	T				T		T
<i>Strelitzia reginae</i> , bird-of-paradise	VH	W	M		T						T
<i>Streptocarpus saxorum</i> , false African violet	M	W	M	T		T			T		
<i>Syngonium podophyllum</i> , nephthytis, arrowhead vine	M	W	L	T		T		T	T	T	T
<i>Tolmiea menziesii</i> , piggy-back plant	H	W	H	T		T			T		
<i>Tradescantia</i> species, wandering Jews	H	W	M			T				T	
<i>Tripogandra multiflora</i> , Tahitian bridal veil	H	W	M			T				T	
<i>Vriesea splendens</i> , flaming sword	H	CR	L		T						T
<i>Zebrina pendula</i> , wandering Jew	H	W	M			T				T	

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