NC STATE UNIVERSITY

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Indoor Plant Selection and Care

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Almost any indoor environment is more pleasant and attractive when living plants are a part of the setting. In apartments, condominiums and single family residences, plants add warmth, personality and year-round beauty. Shopping centers, hotels and resorts take full advantage of the colorful, relaxed atmosphere created by green and flowering plants. Offices, banks and other commercial buildings rely on interior plants to "humanize" the work environment and increase productivity.

There are other important, often overlooked functions performed by indoor plants. These include directing or controlling pedestrian traffic, subdividing or enclosing space into separate areas, reducing glare and reflection from artificial lights or sunlight entering through a window and screening to block out undesirable views or to create privacy.

Real enjoyment and consistent success with indoor plants depend on selecting the right plant for a given environmental situation. Light, temperature and humidity are key considerations. Often one or more of these will be less than ideal. However, by being aware of the shortcomings of an indoor location one can usually alter them or match plants with growing conditions. Soil and water satisfy the remaining basic needs of living plants. A good soil mix and proper watering and fertilization are important for the maintenance of attractive plants.

Light

Light is essential for plant life processes and optimum levels ensure healthy, long-lived indoor plants. In general, there are three categories of light intensity for interior plants: low, 25 to 75 footcandles (fc); medium 75 to 150 fc; and high, 150 to 1000 fc.

It is important to match plants with locations that satisfy their basic light requirements. Many reference books provide interiorscape professionals and home gardeners with information on the light levels necessary to maintain plants indoors. A wide variety of light meters are available for measuring light intensities in indoor environments. They can eliminate much of the guesswork in selecting plants that are adapted to light levels in a given location.

Even a camera equipped with a built-in light meter can give a rough indication of light intensities in footcandle units (Figure 1). Set the film-speed dial to ASA 25 and the shutter speed to 1/60 second. Place opaque white paper next to the leaves of a plant and point the camera at it from a distance no greater than the narrow dimension of the paper. Adjust the lens opening (f-stop) until the built-in meter indicates a correct exposure. Typical f-stop openings and corresponding light intensities are shown in Table 1.

If sunlight is the major light source you may determine which category your indoor location falls into by using the following descriptions:

Table 1. Approximate footcandle readings using a camera to estimate light intensities.

f-stop	Approximate Footcandles
f/2	40
f/2.8	75
f/4	150
f/5.6	300
f/8	600
f/11	1200
f/16	2400

High Light: areas within four feet of large south, east, and west facing windows.

Medium Light: locations in a range of four to eight feet from south and east windows and west windows that do not receive direct sun.

Low Light: areas more than eight feet from windows as in the center of a room, a hallway or an inside wall. Northern exposures often fall into this category, even when close to the window. Many locations that receive only artificial light are also low light situations.

The intensity and duration of natural sunlight that reaches indoor locations varies throughout the year (Figure 2). In winter, days are shorter and the sun's path is lower and farther to the south. Therefore, most plants will receive fewer hours of less intense sunlight from a more southerly angle in the winter. However, plants growing close to an unshaded south window may receive more direct sunlight at this time of year because of the low sun angle. In summer the days are longer and the sun's path is higher above the horizon. For many plants this is the peak growth period.

Keep in mind that there are less obvious factors that affect sunlight levels indoors. These include: the color of interior walls and floors, types of window coverings, roof overhangs, outside awnings, nearby buildings and trees that filter or block incoming light.

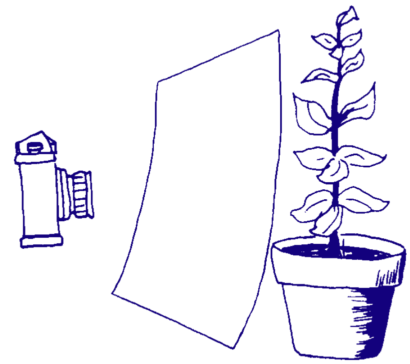

Figure 1. A camera can be used to estimate light intensity.

Plants grown in correct light conditions are vigorous, compact and bushy. Color is vibrant, leaves are normal size, and stems are sturdy. Flowering is promoted. Plants grown at a light intensity below their optimum will have smaller leaves and less vivid color. They often grow more open and leggy and pruning may be necessary for compact form. Keep these plants drier than those in bright light and fertilize them less often. A plant that receives significantly less than its required amount of light may survive for several months to a year, while gradually deteriorating in appearance and vigor.

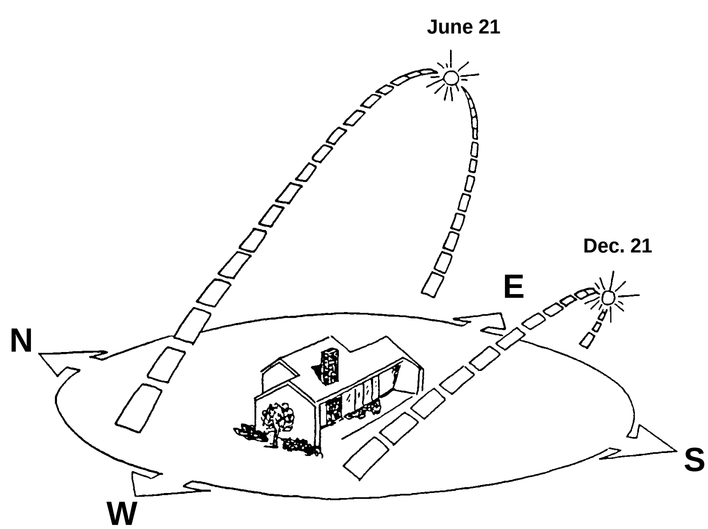

Figure 2. The sun's path across the horizon changes with the seasons as does daylength. Notice how much higher off the horizon the sun is during summer than during winter months.

When light levels are too high, plant leaves show an overall yellowing that results from the destruction of green pigment. Eventually large brown spots of dead tissue may develop. This is often referred to as leaf scorch or leaf burn.

Artificial light can be used to supplement or replace natural sunlight. Cool white fluorescent lights alone or in combination with warm light fluorescent lights are the most economical and best all-purpose lamps. Typically, a fixture holding two 40-watt tubes is positioned approximately 12 inches above the plants. Most plants need 12 to 16 hours of artificial light per day for good growth. For large specimen plants, use spot or flood lights to maintain good appearance and accent the plant. You may consider designing room lighting around your anticipated use of indoor plants. Indirect and track lighting are very effective design features for this purpose. Plants for low, medium, and high light locations are listed in Table 2.

Temperature

Most homes and offices are heated and cooled with human comfort in mind rather than the growth requirements of indoor plants. Fortunately, the desirable temperatures for humans fall within the optimum range for most foliage and flowering plants. Daytime temperatures of 70 to 80 °F and a nighttime range of 60 to 70 °F are satisfactory for most species. Many flowering plants bloom longer at the lower end of these day-night temperature ranges. One room in a building may be cooler than the other while another may be warmer. A minimum/ maximum thermometer will pinpoint such differences. These temperature variations should be considered when you are placing plants.

Sudden temperature changes caused by drafts can be harmful to interior plants. If a plant is positioned near a window, protect it from heat and intense sunlight during the day and from cold, drafty conditions at night. Use shades and curtains or move the plant far enough away from the window to avoid temperature and light extremes. Never place plants near heat registers, fireplaces, or on television sets.

Humidity

Humidity may determine whether certain plants that are native to moist tropical regions will do well in the average indoor location. In dry air, the leaves of these plants turn yellow or show brown tips and margins. Some fail to flower while others produce flower buds that shrivel and drop suddenly from the plant.

In a moderate humidity range of 20 to 40%, it is possible to grow a variety of flowering and foliage plants. However, cactus and other succulents do well in a humidity range of 5 to 15%. A hygrometer can be used to determine the relative humidity of different indoor locations throughout the year.

One of the simplest ways to increase the humidity around plants is to group them close together (Figure 3). Water constantly evaporates into the air from leaf pores (stoma) as well as from soil and some container surfaces, creating a humid microclimate in the immediate area of the plants.

Another technique for increasing humidity is to place watertight saucers or trays holding an inch or two of wet pebbles under plant containers. Add water to the saucer or tray to a point just below the surface of the pebble layer. Humidity increases around the plant as this water evaporates. Make sure the water level in the saucer never rises to the bottom of the pot. If this happens, the container soil will remain constantly wet, toxic salts will accumulate at the soil surface, and roots will be damaged.

Air conditioners tend to make indoor air drier during the summer cooling season. Cool mist vaporizers or room humidifiers provide an effective means of adding moisture to the air. In a home environment sensitive plants can be grown in more naturally humid rooms such as the kitchen, bathroom or laundry room.

Table 2. Indoor plants for low, medium, and high light locations.

Low Light (25-75 fc)	
Aglaonema commutatum	Silver Evergreen
Aglaonema commutatum 'Silver King'	Silver King Evergreen
Aglaonema modestum	Chinese Evergreen
Aspidistra elatior	Cast-Iron Plant
Aspidistra elatior 'Variegata'	Variegated Cast-Iron Plant
Chamaedorea elegans	Parlor Palm
Chamaedorea elegans 'Bella'	Neanthe Bella Palm
Epipremnum aureum	Golden Pothos
Epipremnum aureum 'Marble Queen'	Marble Queen Pothos
Monstera deliciosa	Split-Leaf Philodendron
Sansevieria trifasciata	Snake Plant
Sansevieria trifasciata 'Laurentii'	Goldband Sansevieria
Medium Light (75-150 fc)	
Aechmea fasciata	Silver Vase
Aglaonema commutatum 'White Rajah'	White Rajah Aglaonema
Asparagus densiflorus 'Myers'	Plume Asparagus
Asparagus densiflorus 'Sprengeri'	Sprengeri Asparagus
Asparagus setaceus	Fern Asparagus
Aucuba japonica 'Variegata'	Gold-Dust Plant
*Brassaia actinophylla**.	Schefflera
*Brassaia arboricola**	Dwarf Schefflera
*Chamaedorea erumpens**	Bamboo Palm
Chlorophytum comosum 'Variegatum'	Spider Plant
Cissus rhombifolia	Grape Ivy
Dieffenbachia amoena	Giant Dumbcane
Dieffenbachia amoena 'Exotica'	Exotica Dumbcane
Dieffenbachia maculata	Spotted Dumbcane
Dieffenbachia maculata 'Rudolph Roehrs'	Gold Dieffenbachia
Dizygotheca elegantissima	False Aralia
Dracaena deremensis 'Warneckii'*	Striped Dracaena
Dracaena fragrans 'Massangeana'*	Corn Plant
*Dracaena godseffiana**	Gold-Dust Dracaena
*Dracaena marginata**	Red-Margined Dracaena
*Dracaena sanderana**	Ribbon Plant
Fatsia japonica	Japanese Fatsia
Ficus benjamina	Weeping Fig
Ficus elastica 'Decora'	India Rubber Plant
Ficus lyrata	Fiddle-Leaf Fig
Ficus retusa	Indian Laurel
Gynura aurantiaca	Velvet Plant
Hedera helix	English Ivy
Howea forsterana	Kentia Palm
Maranta leuconeura erythroneura	Red-Veined Prayer Plant
Nephrolepis exatata 'Bostoniensis'	Boston Fern
Pandanus veitchii	Variegated Screw Pine
*Peperomia caperata**	Emerald Ripple Peperomia

Table 2, Continued.

Medium Light (75-150 fc)	
Peperomia obtusifolia	Oval-Leaf Peperomia
Peperomia obtusifolia 'Variegata'	Variegated Peperomia
*Philodendron bipennifolium**	Fiddle-Leaf Philodendron
*Philodendron scandens oxycardium**	Heart-Leaf Philodendron
Philodendron selloum	Tree Philodendron
Pilea cadierei	Aluminum Plant
Pilea involucrata	Friendship Plant
Plectranthus australis	Swedish Ivy
Polyscias balfouriana 'Marginata'	Variegated Balfour Aralia
Saintpaulia sp., & hybrids	African Violet
Spathiphyllum 'Clevelandii'	Cleveland Peace Lily
Spathiphyllum 'Mauna Loa'	Mauna Loa Peace Lily
Syngonium podophyllum 'Trileaf Wonder'*	Trileaf Wonder Nephthytis
Tradescantia fluminensis	Inch Plant
Zebrina pendula	Wandering Jew

High Light (150-1000 fc)	
Aloe barbadensis	Aloe Vera
Alternanthera ficoidea	Joseph's Coat
Araucaria heterophylla	Norfolk Island Pine
Beaucarnea recurvata	Ponytail Palm
*Cissus antarctica***	Kangaroo Vine
Crassula argentea	Jade Plant
*Fatshedera lizei***	Botanical Wonder
Hibiscus rosa-sinensis	Chinese Hibiscus
*Hoya carnosa***	Wax Plant
Iresine lindenii	Blood Leaf
Podocarpus gracilior	Weeping Podocarpus
Rhoeo spathacea	Moses-in-the-Cradle
Sedum morganianum	Burro's Tail
Solenostemon blumei	Coleus

*May also be conditioned to grow in low light.

**May also be conditioned to grow in medium light.

Soil

Many commercial potting soils for interior plants are available. They vary in price, ingredients, and physical and chemical characteristics. It may be necessary to try several before you find one that gives good results under your conditions. The following points should help make the selection process easier.

Good drainage with adequate water retention is essential. A fine-textured heavy soil mix that holds too much water will suffocate plant roots. On the other hand, a light, coarse-textured potting soil that drains too quickly may not retain adequate water and nutrients for normal plant growth. Almost all potting soils include two or more ingredients. These should be thoroughly and uniformly mixed for good root growth.

Un-sterilized garden soils are not recommended for indoor plants. Besides questionable water- and nutrient-holding characteristics in containers, they may carry insect eggs, weed seeds and disease organisms.

Figure 3. Placing plants close together creates a humid microclimate for better plant growth.

Water

Watering indoor plants is a widely misunderstood practice. As a result, improper watering is the underlying cause of many plant problems. There are several basic points to consider:

❶ Plants with large or very thin leaves and those with fine surface roots usually require more frequent watering than succulent plants with fleshy leaves and stems that are able to store water internally.

❷ In a warm, dry, sunny location, plants need more frequent watering than they do in cool, low-light situations.

❸ A large plant in a small pot will need water more often than a small plant in a large pot.

❹ Flowering plants and rapidly growing plants dry out more quickly than plants with slow growth rates.

❺ Different soil mixes require different watering schedules. Heavy fine-textured potting media and those that contain a lot of peat moss hold more moisture than loose, porous mixtures of bark, sand and perlite.

❻ Water evaporates rapidly from the sides of an untreated porous clay pot, but not at all from plastic or glazed ceramic containers. In either case, water scheduling will be affected.

❼ Water thoroughly every time you water a plant. Apply enough water to moisten the entire soil volume, plus a little extra to leach soluble salts out of the container. Indoor plants are usually placed in saucers to hold excess water that drains from the bottom of the pot. If the plant is left standing in this water, the moisture will be reabsorbed into the pot. This results in root rot, salt injury, and generally poor plant performance. To prevent the problem, discard any water in the saucer after each irrigation, or elevate the base of the container above the level of drainage water. One way to do this is to spread a layer of gravel in the bottom of the saucer deep enough to keep the bottom of the container out of the water (Figure 4).

The feel of the soil should be one guide in watering indoor plants. When the top half-inch of the soil in containers up to 8–10 inches in diameter feels dry, the plant probably needs watering. Cacti and succulents can go without water for longer periods. Many interior plants that are not given artificial light go into a resting stage during the short cool days of winter. During this season watering should be reduced.

You can also watch the plant itself for signs of over- or under-watering. Plant symptoms of these problems are described in Table 3.

Fertilizer

Fertilizers for indoor plants should contain nitrogen, phosphorus and potassium. The analysis is printed on the label and indicates the percent by weight of each nutrient in the formulation (e.g., 5-10-5). The first number represents nitrogen (N), the second phosphorus (P_2O_5, or available phosphoric acid), and the third potassium (K_2O, available or soluble potash). Most indoor plants grow vigorously with a 1-1-1 ratio (i.e., 20-20-20) fertilizer. However, you may want to increase the ratio of nitrogen for a nonflowering plant, such as foliage plants. Liquid fertilizers are convenient for indoor gardeners. Water-soluble granular, pill, and slow release forms are also effective. Regardless of the analysis and

Figure 4. Place gravel in saucers to allow for good drainage.

formulation, always follow manufacturers' rate of application directions.

Observation will guide you in determining your plant's fertilizer needs. As a rule, applications should be more frequent when the plants are in a growth stage. This is usually in the spring and summer when sunlight intensity increases and the warm days are longer. During the short days of winter, many indoor plants that receive little or no artificial light enter a resting stage. If plants go into a winter rest period, it's best to give them little, if any, fertilizer. Plants that have just been transplanted or repotted will obtain sufficient nutrients from the fresh potting soil for at least 4 to 8 weeks. They do not require supplemental fertilizer during this time.

Containers

There are several points to consider when selecting a container for an indoor plant, including container size and shape. A plant will not thrive in a pot that is too large or too small. As a rule, the diameter of the pot should be about one-third the height of the plant from the top of the foliage. Plants with shallow roots (like cacti) grow best in shallow containers. Deep-rooted plants need more room and require a taller container.

Indoor plant containers are made of many materials, but clay and plastic are most widely used. Untreated clay pots allow moisture to evaporate from the soil through the sides of the container. This promotes soil aeration and root growth. On the other hand, the soil dries faster and plants need watering more often in porous clay pots than in most other types of containers. Plastic pots retain moisture longer. It's important, therefore, to ensure good drainage and to avoid over watering. Plastic pots are also easier to clean, lighter in weight, and generally less expensive than clay containers.

Perhaps the most important characteristic of an indoor plant container is that it have one or more drainage holes. This permits rapid escape of drainage water, leaching of excess salts, and reentry of air into larger pore spaces in the soil. Plants grown in containers that have no drainage holes are easily injured or killed by over watering.

Grooming

The leaves of indoor plants can become coated with a heavy layer of dust in a surprisingly short time. This dust and grime interferes with normal leaf functions and makes the plant less attractive. Use a soft cloth moistened with warm water to clean both upper and lower leaf surfaces at least every two or three months. Plants that are small enough to move into the shower or outdoors onto the patio for a mild soapy wash and rinse in warm weather will be more attractive and less prone to insect problems. Plant leaf-shine materials should be avoided. They attract dust and can slow plant growth.

Plants should be turned regularly if possible to expose all sides to light coming from one direction. This encourages a more uniform shape. Remove yellow or discolored foliage as it develops. Dried brown leaf tips and margins may be trimmed back to green tissue with scissors. Follow the shape of the leaf when making these cuts to maintain natural appearance.

Following these guidelines should help you in your house plant care and increase your plant success. For further information, contact your local County Extension Center.

Table 3. Diagnosing symptoms of common indoor plant problems.

Possible Causes:	Foliage: wilt	Foliage: spots	Foliage: all drop	Foliage: oldest drop	Foliage: yellowish green	Foliage: bend down and curl	Foliage: tips or margins brown	Growth: plant died	Growth: none develop	Growth: new leaves small	Growth: weak, thin and soft	Flowers: no blooms	Flowers: become smaller	Flowers: decline too fast	Flowers: color is less intense	Flowers: fail to develop--bud drop
EXCESS LIGHT: i.e. exposure to direct sun can be too intense for many plants.	●	●			●											
INSUFFICIENT LIGHT: impairs photosynthesis and flowering.				●	●					●	●	●	●		●	●
DAYLENGTH: if too short reduces growth, flowering and life-expectancy.								●	●	●		●				●
HIGH TEMPERATURE: especially at night reduces growth and vigor, also detrimental for flowering.	●			●	●					●	●	●		●	●	●
LOW TEMPERATURE: continued exposure is adverse to plant growth.		●				●		●	●							●
LACK OF WATER: limiting factor for growth and survival.	●	●	●	●			●	●	●	●				●		●
OVERWATERING OR POOR DRAINAGE: reduces soil aeration--roots die, water and nutrients are not absorbed.	●		●	●	●		●	●	●	●	●				●	●
TOO MUCH FERTILIZER: accumulation of soluble salts injures plant roots, reduces water uptake.	●		●	●	●		●	●	●	●						●
LACK OF FERTILIZER: causes a deficiency of nutrients required for plant growth.				●	●		●			●	●		●		●	●
COMPACTED SOIL: reduces root functions and activity.	●			●	●					●	●		●		●	●
GROWING CONTAINER: too small or too large in relation to plant size.	●					●			●	●		●	●			
LOW HUMIDITY: air too dry to maintain healthy growth and flowering.			●	●	●	●	●	●	●	●		●	●	●		●