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Lighting the Way to Gardening Indoors

The end of the growing season does not necessarily mean that gardeners cannot continue to enjoy working with plants. It simply means that plant-growing activities must be moved indoors. The availability of adequate light usually most often is the limiting factor to plant production in the average home. If the construction of a hobby greenhouse is beyond one's financial means, then the use of artificial lighting represents a less expensive way of allowing plant enthusiasts to "ply their trade" throughout the cold months of winter.

Light is very important for green plants. It provides the energy plants need to make the food required for them to grow and flower. Plants are the only organisms able to use light to produce sugars, starches and other substances needed by them as well as by other living organisms.

Visible light is a form of electro-magnetic wave radiation whose color can be expressed in terms of its wavelength. Certain wavelengths of light are more important for proper plant growth than are others. Leaves reflect and derive little energy from the yellow and green wavelengths of the visible light spectrum. By contrast, the red and blue portions of the light spectrum are the most important for providing the energy needed for the process of photosynthesis. Plants growing outdoors, in greenhouses or close to windows are exposed to a natural balance of the blue and red light wavelengths that plants need. When plants receive little or no natural light, additional light from artificial sources must be provided and those light sources that emit a mixture of red and blue wavelengths are preferable.

Most homes are illuminated with incandescent lights. As a single light source for plants, incandescent lamps are less than satisfactory since they emit an abundance of red light but very little blue. Additionally, they produce an abundance of infrared (heat) rays, which is detrimental to most plants. If used, they must be located some distance

from the plants to keep leaves from overheating. This, in turn, reduces the intensity of the light plants receive. Incandescent light bulbs also are only about one-third as efficient as fluorescent bulbs (tubes) in converting electrical energy to light. Furthermore, the life of a standard incandescent bulb is often only about 1,000 hours, whereas the life of a fluorescent tube is normally 10,000 hours or more.

Fluorescent lamps provide one of the best artificial light sources available for growing plants in the home. Other light sources such as sodium-vapor and metal halide lamps (often referred to as high-intensity discharge or HID lights) may be used but are not as readily available or adaptable for home use because of their size. Fluorescent tubes use less electricity and produce less heat than incandescent bulbs on a per-watt equivalency. They are available in many sizes and shapes including straight, circular, and U-shaped. Straight tubes in 2-, 4- or 8-foot lengths are used most frequently. Most straight fluorescent tubes are rated at 10 watts per foot of length.

Many indoor gardeners use cool-white fluorescent tubes; warm-white fluorescent tubes also seem fairly effective. However, fluorescent tubes listed as white or daylight are less desirable for indoor plant growth. Cool-white tubes produce a small amount of red light in addition to orange, yellow-green and blue. Unfortunately,

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the amount of red light produced is less than ideal. Unless plants are near a window, additional artificial light that produces additional red wavelengths is preferred. A few incandescent bulbs in the growing area can furnish needed red light. A ratio of from three to ten watts of incandescent light for every 100 watts of fluorescent light is considered satisfactory.

Special fluorescent tubes (often referred to as plant or grow lights) have been developed for growing plants indoors. These tubes have a higher output in the red range to balance the blue output. Many indoor gardeners have found that these tubes can be used in combination with cool-white tubes. A blend (by wattage) of 50 percent cool white bulbs and 50 percent grow light bulbs is considered ideal by most authorities. This method is more economical than using all plant-light tubes, since cool-white tubes cost much less than the special plant-light tubes.

Recently, a considerable amount of research has been conducted on the use of light-emitting diodes (LEDs) as a light source for growing plants indoors. The result has been the development of a long-lived source of light produced in the exact colors/wavelengths needed by plants to carry out photosynthesis. Although the initial cost of an LED setup is greater than that for fluorescent, this source of light is the most economical in converting electrical energy into light. Several companies now manufacture LED panels which can be used in light gardens or other indoor settings where artificial illumination is required for plant growth.

The amount of light necessary for good growth varies with plant species. In general, many of the light fixtures available for home plant lighting make it practically impossible to produce too much light for most plants. Plants that can adapt to interior settings usually are divided into three general categories: those suitable for low, medium and high light intensities. The categories generally indicate the minimum light required. Growth is often best at the higher end of these suggested light ranges.

Low-light plants. Plants referred to as low light intensity plants can survive under light intensities between 50 and 250 foot-candles. A foot-candle (f.c.) can be defined

as the intensity of light falling on a surface equal to one lumen per square foot. Many tropical interior plants (e.g. Chinese evergreen and pothos) fall into this category.

Medium-light plants. These plants prefer at least 250 to 1,000 f.c. of light. Best growth occurs above 750 foot-candles unless plants also receive extended periods of direct, natural light. Ideally, artificial light for plants in this category should be in the 500 to 1,000 f.c. range. Outdoor plants that are shade-loving often fit into this category.

High-light plants. These plants generally are less satisfactory for growing under artificial lights in the home because of their need for high amounts of light. However, for those up to the challenge, special HID lamps may be required. Plants in this category need at least 1,000 f.c., for best growth. Most outdoor plants that thrive in full-sun settings belong to this category.

As a general rule, plants growing under artificial lighting should be located with the tips of their leaves six to 12 inches from the light source. If HID lamps are used the distance needs to be increased considerably due to the intensity of light as well as the amount of heat emitted by the lamp. Also, fluorescent tubes do not produce as much light at the ends as they do in the center. Therefore, the brightest spot under a fluorescent fixture is directly beneath the center of the tubes.

In most cases, plants receiving no outdoor light through windows, sky lights, etc. should be illuminated from 16 to 18 hours each day. If some additional natural light is received, 12 to 14 hours each day may be adequate. Lights should be used at the same time that natural light is received by plants. Using lights at the beginning or end of the day usually will not be as effective as using lights during daylight unless natural daylight is quite bright.

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November Gardening Calendar

Ornamentals

- **Weeks 1-4:** Continue watering evergreens until the ground freezes. Soils must not be dry when winter arrives.
- **Weeks 1-4:** Now is the ideal time to plant trees and shrubs. Before digging the hole, prepare the site by loosening the soil well beyond the drip line of each plant. Plant trees and shrubs at the depth they grew in the nursery and not deeper. Remove all wires, ropes and non-biodegradable materials from roots before back filling. Apply a 2-3 inch mulch layer, but stay several inches away from the trunk. Keep the soil moist, not wet, to the depth of the roots.
- **Weeks 1-4:** Remove the spent flowers and foliage of perennials after they are damaged by frost.
- **Weeks 1-3:** Newly planted broad-leaf evergreens such as azaleas, boxwood and hollies benefit from a burlap screen for winter wind protection. Set screen stakes in place before the ground freezes.
- **Week 1:** Now is a good time to observe and choose nursery stock based on fall foliage interest.
- **Week 1:** Plant tulips now.
- **Weeks 3-4:** Mums can be cut back to within several inches of the ground once flowering ends. After the ground freezes, apply a 2 to 3 inch layer of loose mulch such as pine needles, straw or leaves.
- **Weeks 3-4:** Mulch flower and bulb beds after the ground freezes, to prevent injury to plants from frost heaving.
- **Weeks 3-4:** Roses should be winterized after a heavy frost. Place a 6 to 10-inch deep layer of mulch over each plant. Top soil works best. Prune sparingly, just enough to shorten overly long canes. Climbers should not be pruned at this time.
- **Weeks 3-4:** Take steps to prevent garden pools from freezing solid in winter. Covering pools with an insulating material, or floating a stock tank water heater in the pond, will lessen the chance of ice damage.
- **Weeks 3-4:** Covering garden pools with bird netting will prevent leaves from fouling the water. Oxygen depletion from rotting organic matter can cause winter kill of pond fish.

Vegetables

- **Weeks 1-4:** Fall tilling the vegetable garden exposes many insect pests to winter cold, reducing their numbers in next years garden.
- **Weeks 1-4:** Any unused, finished compost is best tilled under to improve garden soils.
- **Weeks 1-4:** To prevent insects or diseases from over-wintering in the garden, remove and compost all plant debris.
- **Weeks 1-3:** Overcrowded or unproductive rhubarb plants can be divided now.
- **Weeks 3-4:** Root crops such as carrots, radishes, turnips and Jerusalem artichokes store well outdoors in the ground. Just before the ground freezes, bury these crops under a deep layer of leaves or straw. Harvest as needed during winter by pulling back this protective mulch.
- **Week 4:** Thanksgiving - Weave a holiday wreath of garlic, onions, chili peppers and herbs. It will make a gourmet gift for a lucky friend.

Fruits

- **Weeks 1-4:** Keep mulches pulled back several inches from the base of fruit trees to prevent bark injury from hungry mice and other rodents.
- **Week 1:** Harvest pecans when they start to drop from trees. Shake nuts onto tarps laid on the ground.
- **Week 1:** Fallen, spoiled or mummified fruits should be cleaned up from the garden and destroyed by burying.
- **Weeks 3-4:** A dilute whitewash made from equal parts interior white latex paints and water, applied to the southwest side of young fruit trees will prevent winter sun scald injury.
- **Weeks 3-4:** Commercial tree guards or protective collars made of 18-inch high hardware cloth will prevent trunk injury to fruit trees from gnawing rabbits and rodents.
- **Weeks 3-4:** Mulch strawberries for winter with straw. This should be done after several nights near 20 degrees, but before temperatures drop into the teens. Apply straw loosely, but thick enough to hide plants from view.

Miscellaneous

- **Weeks 1-4:** Now is a good time to collect soil samples to test for pH and nutritional levels.
- **Weeks 1-4:** Roll up and store garden hoses on a warm, sunny day. It's hard to get a cold hose to coil into a tight loop.
- **Weeks 1-4:** To prevent injury to turf grasses, keep leaves raked up off of the lawn.
- **Weeks 1-4:** Continue mowing lawn grasses as long as they keep growing.
- **Weeks 1-4:** A final fall application of fertilizer can be applied to bluegrass and fescue lawns now.
- **Weeks 2-4:** Clean house gutters of leaves and fallen debris before cold wet weather sets in.
- **Weeks 2-4:** Set up bird feeders. Birds appreciate a source of unfrozen drinking water during the winter.
- **Weeks 2-4:** Be sure to shut off and drain any outdoor water pipes or irrigation systems that may freeze during cold weather.
- **Weeks 3-4:** For Cyclamen to bloom well indoors, they need cool temperatures in the 50-60 degree range, bright light, evenly moist soils, and regular fertilization.
- **Weeks 3-4:** Reduce or eliminate fertilizing of houseplants until spring.

Gardening Calendar supplied by the staff of the William T. Kemper Center for Home Gardening located at the Missouri Botanical Garden in St. Louis, Missouri. (www.GardeningHelp.org)