



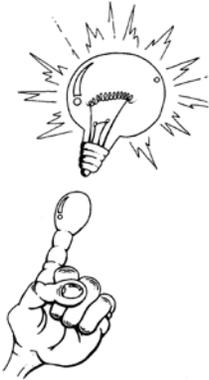
MASTER GARDENER
COLORADO STATE UNIVERSITY
EXTENSION

CMG GardenNotes #142

Plant Growth Factors: Light

Outline: Light quality, page 1
Light intensity (sun and shade), page 2
Light duration, page 4
Photoperiod, page 4

Thought questions



Explain the science behind the following gardening questions.

- o Why won't my African violets bloom? They are on a table near a bright northern window.
 - o Why is my flowerbed doing poorly? I planted it with a variety of semi-shade annuals since it gets sun only in the afternoon. Plant growth is minimal and foliage is bleached out. The impatiens wilt even when the soil is moist.
 - o I shear my shrubs a couple of times a year into nice rounded shapes. Why are they becoming thick woody stems at the base with lots of dead twigs?
 - o Why won't my Christmas cactus blossom? It is in front of a bright window and the plant is full and robust. It is a cutting from my mother's plant that she keeps in the guest bedroom and which blooms profusely each Christmas and again in the spring.
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The quality, intensity, and duration of light directly impact plant growth.

Light Quality

Light quality refers to the color or wavelength reaching the plant's surface. A prism (or raindrops) can divide sunlight into respective colors of red, orange, yellow, green, blue, indigo and violet.

Red and blue have the greatest impact on plant growth. Green light is least effective (the reflection of green light gives the green color to plants). Blue light is primarily responsible for vegetative leaf growth. Red light, when combined with blue light, encourages flowering.

Light quality is a major consideration for indoor growing.

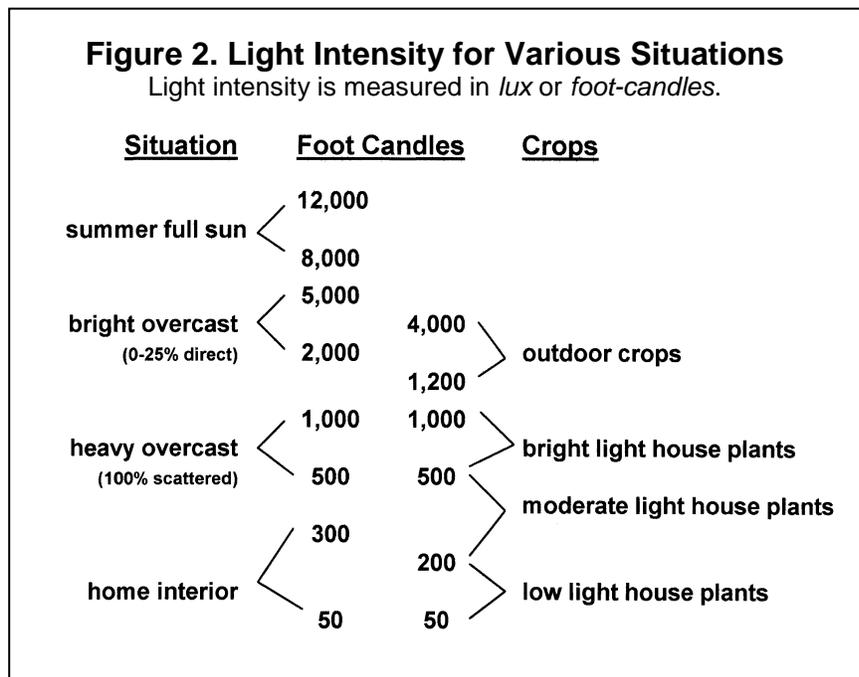
- Fluorescent cool white lamps are high in the blue range, and the best choice for starting seeds indoors.
- For flowering plants that need more red light, use broad spectrum fluorescent bulbs.
- Incandescent lights are high in red and red-orange, but generally produce too much heat for use in supplementing plant growth.

Figure 1. Relative efficiency of various light colors in photosynthesis.



Light Intensity

The more sunlight a plant receives, to a degree, the higher the photosynthetic rate will be. However, leaves of plants growing in low light readily sun scorch when moved to a bright location. Over time, as the wax content on a leaf increases, it will become more sun tolerant.



As illustrated in Figure 2, light levels in most homes are below that required for all but low light house plants. Except for rather bright sunny rooms, most house plants can only be grown directly in front of bright windows. Inexpensive light meters are available in many garden supply stores to help the indoor gardener evaluate light levels.

Landscape plants vary in their adaptation to light intensity. Many gardening texts divide plants into sun, partial sun and shade. However the experienced gardener understands the differences between these seven degrees of sun/shade:

Full sun – Direct sun for at least 8 hours a day, including from 9 a.m. to 4 p.m.

Full sun with reflected heat – Where plants receive reflected heat from a building or other structure, temperatures can be extremely hot. This situation significantly limits the choice of plants for the site.

Morning shade with afternoon sun – This southwest and west reflected heat can be extremely hot and limiting to plant growth.

Morning sun with afternoon shade – This is an ideal site for many plants. The afternoon shade protects plants from extreme heat.

Filtered shade – Dappled shade filtered through trees can be bright shade to dark shade depending on the tree's canopy. The constantly moving shade pattern protects under-story plants from heat. In darker dappled shade, only the more shade-tolerant plants will thrive.

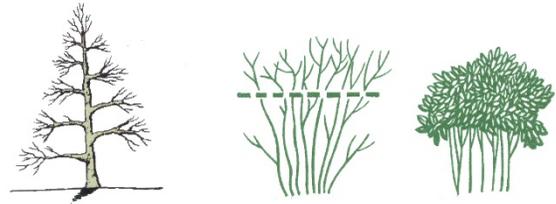
Open shade – Plants may be in the situation where they have open sky above, but direct sunlight is blocked during the day by buildings, fences and other structures. Only more shade-tolerant plants will thrive here.

Closed shade – The situation where plants are under a canopy blocking sunlight is most limiting. Only the most shade-tolerant plants will survive this situation, like under a deck or covered patio.

In hot climates, temperature is often a limiting factor related to shade. Some plants, like impatiens and begonias, may require shade as an escape from heat. These plants will tolerate full sun in cooler summer climates.

Light penetration is a primary influence on correct pruning. For example, dwarf apple trees are pruned to a Christmas tree shape. This gives better light penetration for best quality fruit. Mature fruit trees are thinned each spring for better light penetration. A hedge should be pruned with a wider base and narrow top. Otherwise the bottom thins out due to the shade from above. A common mistake in pruning flowering shrubs is to shear off the top. The resulting regrowth gives a thick upper canopy that shades out the bottom foliage.

Figure 3. Light penetration is a primary influence in pruning. Left: Dwarf apple trees pruned to a Christmas tree shape allow better light penetration for best quality fruit. Right: Regrowth on flowering shrubs that are sheared on top is a very heavy upper canopy growth. This shades out the bottom creating a woody base.



Light Duration

Light duration refers to the amount of time that a plant is exposed to sunlight. Travelers to Alaska often marvel at the giant vegetables and flowers that grow under the long days of the arctic sun even with cool temperatures.

Plants are generally intolerant of continuous light for 24 hours.

Photoperiod

The flowering response of many plants is controlled by the *photoperiod* (the length of uninterrupted darkness). Photoperiod response can be divided into three types.

Short day plants flower in response to long periods of night darkness.

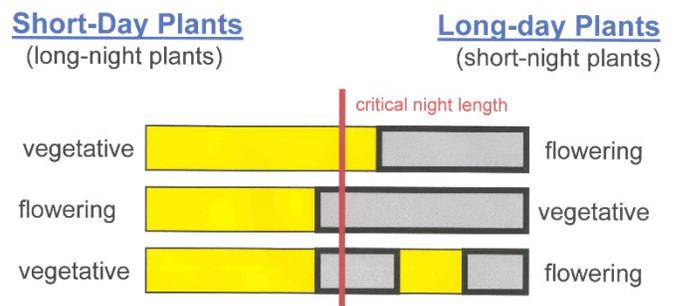
Examples include poinsettias, Christmas cactus, chrysanthemums, and single-crop strawberries.

Long day plants flower in response to short periods of night darkness.

Examples include onions and spinach.

Day neutral plants flower without regard to the length of the night, but typically flower earlier and more profusely under long daylight regimes. Day neutral strawberries provide summer long harvesting (except during heat extremes).

Figure 4. Photoperiod and Flowering - Left side: Short day plants flower with uninterrupted long nights. Right side: Long-day plants flower with short nights or interrupted long nights.



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