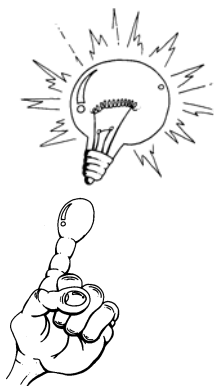


CMG GardenNotes #142

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 in the family room 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.
-

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.

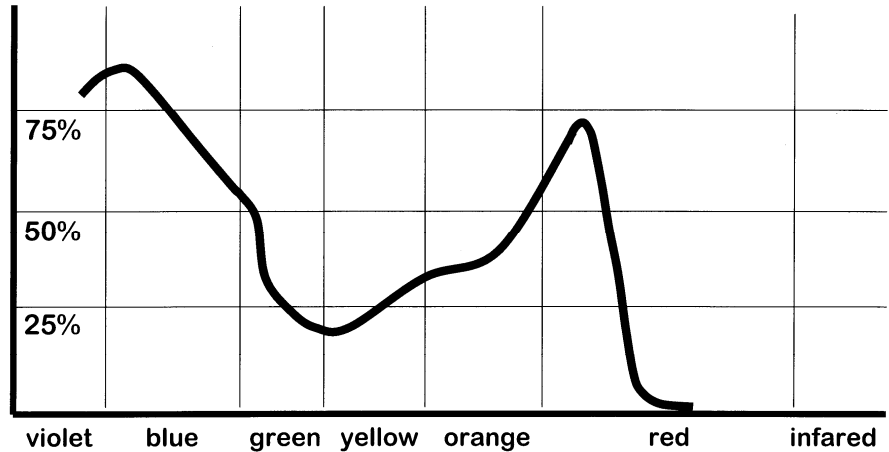
Red and blue have the greatest impact on plant growth. Green light is least effective (the reflection of green light gives the green color to plants). Blue light is primarily responsible for vegetative leaf growth. Red light, when combined with blue light, encourages flowering.

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.

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 scorch when moved to a bright location. Over time, as the wax content on a leaf increases, it will become more sun tolerant.

Light Intensity for various situations
Light intensity is measured in *lux* or *foot-candles*.

<u>Situation</u>	<u>Foot Candles</u>	<u>Crops</u>
summer full sun	12,000	outdoor crops bright light house plants moderate light house plants low light house plants
	8,000	
bright overcast (0-25% direct)	5,000	
	2,000	
heavy overcast (100% scattered)	4,000	
	1,200	
	1,000	
	500	
home interior	500	
	300	
	200	
	50	

As illustrated above, interior 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.

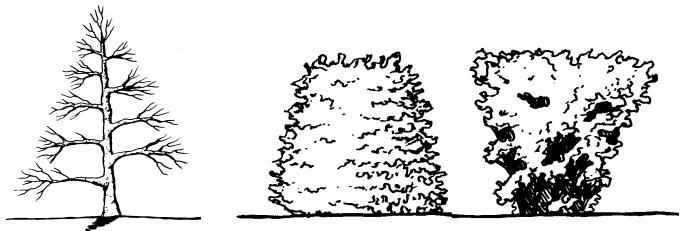
Filtered shade – Dappled shade filtered through trees can be bright shade to dark shade depending on the tree's canopy. The constantly moving shade pattern protects under-story plants from heat. In darker dappled shade, only the more shade tolerant plants will thrive.

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. Here only more shade tolerant plants will thrive.

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.

Pruning of fruit trees, shade trees and shrubs is, in part, a light management tool.



Light penetration is one of the primary objectives of pruning. Dwarf apple trees are pruned to a cone shape to allow better light penetration. A hedge that is pruned narrow at the base will thin out due to low light levels.

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.

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.

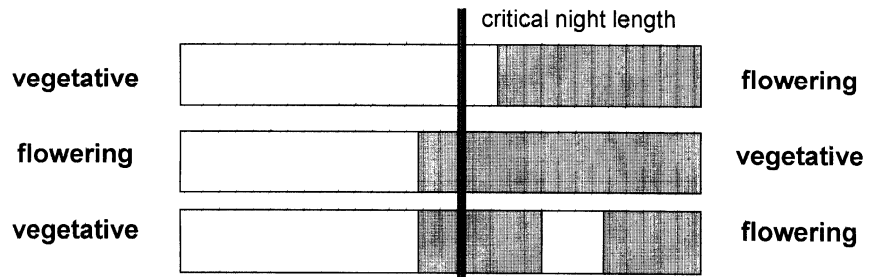
Long day plants flower in response to short periods of night darkness.

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).

Short Day Plants

Long Day Plants



Authors: David Whiting, Colorado State University Extension; Michael Roll and Larry Vickerman (former CSU employees). Line drawings by Scott Johnson

- Colorado Master Gardener *GardenNotes* are available on-line at www.cmg.colostate.edu.
- Colorado Master Gardener training is made possible, in part, by a grant from the *Colorado Garden Show, Inc.*
- Colorado State University, U.S. Department of Agriculture and Colorado counties cooperating.
- Extension programs are available to all without discrimination.
- No endorsement of products mentioned is intended nor is criticism implied of products not mentioned.
- Copyright 2003-2007. Colorado State University Extension. All Rights Reserved. *CMG GardenNotes* may be reproduced, without change or additions, for non-profit educational use.



Revised December 2009