Environmental factors influencing plant growth and flower production

If any environmental factor is less than ideal, it limits a plant's growth and/or distribution. Either directly or indirectly, most plant problems are caused by environmental stress. In some cases, poor environmental conditions (e.g., too little water) damage a plant directly. In other cases, environmental stress weakens a plant and makes it more susceptible to disease or insect attack.

Environmental factors that affect plant growth include light, temperature, water, humidity, and nutrition. It is important to understand how these factors affect plant growth and development. With a basic understanding of these factors, you may be able to manipulate plants to meet your needs, whether for increased leaf, flower, or fruit production. By recognizing the roles of these factors, you also will be better able to diagnose plant problems caused by environmental stress.

- ## Light

Three principal characteristics of light affect plant growth: **quantity**, **quality**, and **duration**.

Quantity

Light quantity refers to the intensity, or concentration, of sunlight. It varies with the seasons. The maximum amount of light is present in summer, and the minimum in winter. Up to a point, the more sunlight a plant receives, the greater its capacity for producing food via photosynthesis.

Increase light by surrounding plants with reflective materials, a white background, or supplemental lights. Decrease it by shading plants.

Quality

Light quality refers to the color (wavelength) of light. Sunlight supplies the complete range of wavelengths and can be broken up by a prism into bands of red, orange, yellow, green, blue, indigo, and violet.

Blue and red light, which plants absorb, have the greatest effect on plant growth. Blue light is responsible primarily for vegetative (leaf) growth. Red light, when combined with blue light, encourages flowering. Plants look green to us because they reflect, rather than absorb, green light.

Duration

Duration, or **photoperiod**, refers to the amount of time a plant is exposed to light. Photoperiod controls flowering in many plants

Plants are classified into three categories: short-day (long-night), long-day (short-night), or day-neutral, depending on their response to the duration of light or darkness. **Short-day** plants form flowers only when day length is less than about 12 hours. Many spring- and fall-flowering plants, such as chrysanthemum, poinsettia, and Christmas cactus, are in this category.

long-day plants form flowers only when day length exceeds 12 hours. Most summer flowering plants (e.g., rudbeckia, California poppy, and aster), as well as many vegetables (beet, radish, lettuce, spinach, and potato), are in this category.

Day-neutral plants form flowers regardless of day length. Examples are tomato, corn, cucumber, and some strawberry cultivars. Some plants do not fit into any category, but may respond to combinations of day lengths. Petunias, for example, flower regardless of day length, but flower earlier and more profusely with long days.

- **Temperature**

Temperature influences most plant processes, including photosynthesis, transpiration, respiration, germination, and flowering. As temperature increases (up to a point), photosynthesis, transpiration, and respiration increase. When combined with day-length, temperature also affects the change from vegetative (leafy) to reproductive (flowering) growth. Depending on the situation and the specific plant, the effect of temperature can either speed up or slow down this transition.

Germination

The temperature required for germination varies by species. Generally, cool-season crops (e.g., spinach, radish, and lettuce) germinate best at 55° to 65°F, while warm-season crops (e.g., tomato, petunia, and lobelia) germinate best at 65° to 75°F.

Flowering

Sometimes horticulturists use temperature in combination with day length to manipulate flowering. If temperatures are high and days are long, cool-season crops such as spinach will flower (bolt). However, if temperatures are too cool, fruit will not set on warm-season crops such as tomato.

Crop quality

Low temperatures reduce energy use and increase sugar storage.

Breaking dormancy

Daffodils can be forced to flower by storing the bulbs at 35° to 40°F in October. The cold temperature allows the bulbs to mature. When transferred to a greenhouse in midwinter, they begin to grow, and flowers are ready to cut in 3 to 4 weeks.

- # Water and Humidity

Most growing plants contain about 90 percent water. Water plays many roles in plants. It is:

- A primary component in photosynthesis and respiration.
- A solvent for minerals and carbohydrates moving through the plant.
- Responsible for cooling leaves as it evaporates from leaf tissue during transpiration.
- The source of pressure to move roots through the soil.
- The medium in which most biochemical reactions take place.

Relative humidity is the ratio of water vapor in the air to the amount of water the air could hold at the current temperature and pressure. Warm air can hold more water vapor than cold air. Relative humidity (RH) is expressed by the following equation:
RH = water in air ÷ water air could hold (at constant temperature and pressure)

- ## Plant Nutrition

Plant nutrition often is confused with fertilization. **Plant nutrition** refers to a plant's need for and use of basic chemical elements. **Fertilization** is the term used when these materials are added to the environment around a plant. A lot must happen before a chemical element in a fertilizer can be used by a plant.

- Plants need 17 elements for normal growth. Three of them--carbon, hydrogen, and oxygen--are found in air and water. The rest are found in the soil.
- Six soil elements are called **macronutrients** because they are used in relatively large amounts by plants. They are nitrogen, potassium, magnesium, calcium, phosphorus, and sulfur.

- **Fertilizers**

Fertilizers are materials containing plant nutrients that are added to the environment around a plant. Generally, they are added to the water or soil, but some can be sprayed on leaves. This method is called **foliar fertilization**.
It should be done carefully with a dilute solution, because a high fertilizer concentration can injure leaf cells.