

Unit C: Plant Physiology



**Lesson 2: Understanding Light,
Temperature, Air, and Water
Effects on Plant Growth**

Terms

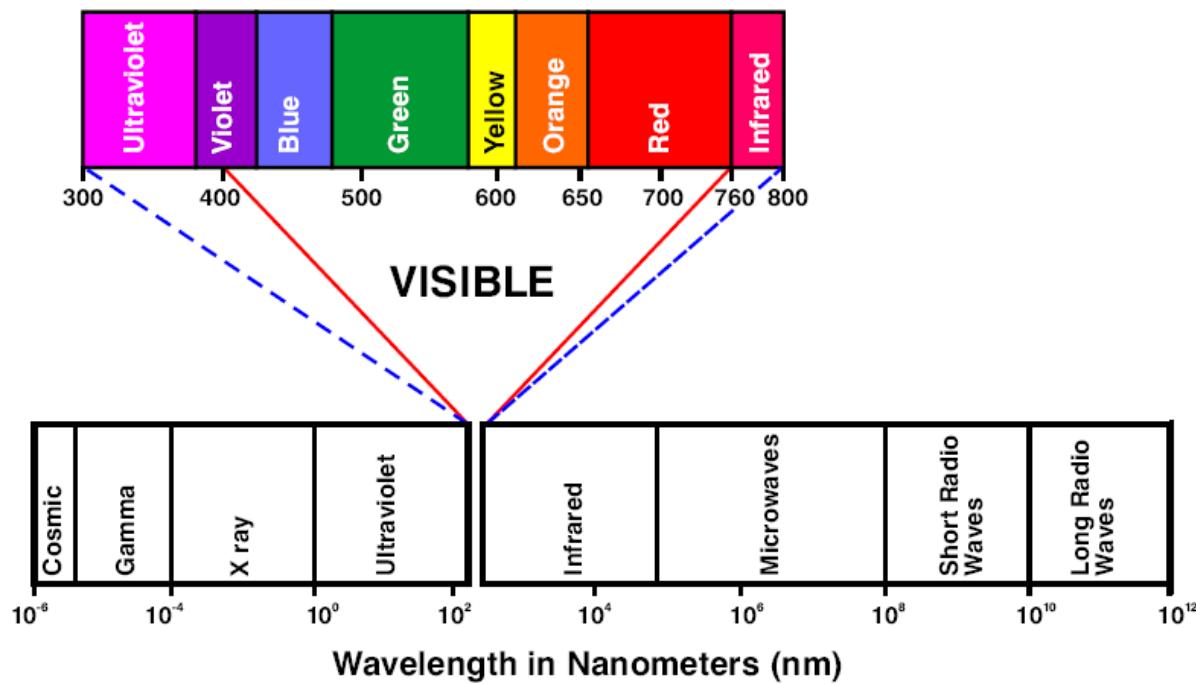
- Day neutral plant (DNP)
- Foot-candles
- Hardiness
- Long day plant (LDP)
- Photoperiod
- Short day plant (SDP)
- Visible light spectrum
- Wilted



How Does Light Affect Plants?

- Plants have adapted, over millions of years, to use sunlight as their source of energy
 - They do this using a pigment called chlorophyll to photosynthesize
- Plants use light in the ***visible light spectrum*** – a narrow band of radiant energy that we can see with our eyes

THE LIGHT SPECTRUM



- Plants need mostly the colors blue and red to activate the chlorophyll
 - There are other pigments that trap this energy and pass it to chlorophyll
 - Ex. Xanthophylls trap violet-blue light; Carotenoids trap red, orange and yellow light
- The fact that plants need a lot of both blue and red light means that neither regular light bulbs (lacking blue light) nor regular fluorescent tubes (lacking red light) provide adequate light for most plants





- Special grow lights are made to produce the correct wavelengths of light
- The intensity of light matters a great deal to the plant

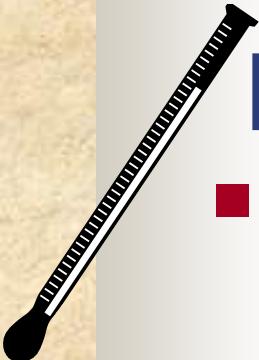


- It is measured in ***foot-candles*** = the amount of light given off by a candle a foot away
 - Plants have adapted to a wide variety of intensities
 - Many plants require full sun, some can withstand full shade
 - Most houseplants can thrive on lower light intensities

- Plants also respond to the length of light, or ***photoperiod***; Plants are grouped into one of three photoperiods:
 - A. ***Short day plants (SDP)*** – flower as the days grow shorter and the nights are over 12 hours long
 - Ex. *Chrysanthemums*, poinsettias, *Kalanchoe*
 - B. ***Long day plants (LDP)*** – flower as days grow longer and the nights are under 12 hours long
 - Ex. Corn, coneflowers, carnations,
 - C. ***Day neutral plants (DNP)*** – are plants whose flower response is unaffected by photoperiod
 - Ex. African violets, tomatoes, many foliage plants

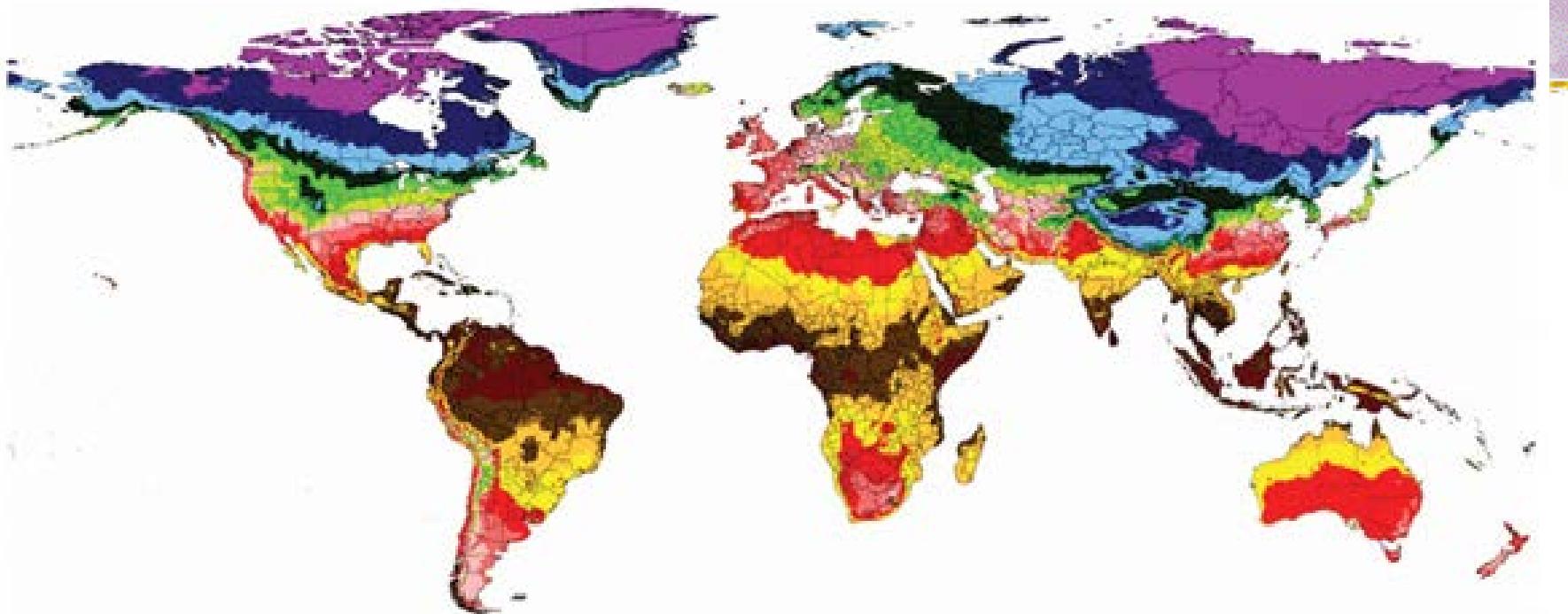


What Temperatures Are Best For Plants?



- Plants have adapted to a wide range of temperatures
 - Some thrive in the arctic circle, others can survive the blazing sun of the desert
- Plants tend to adapt to higher temperatures with smaller leaves in lighter colors and thicker cuticles
- Plants in lower temperatures seem to grow lower to the ground, have shorter life cycles and curved flowers to trap heat and light
- Even though there are extremes, plants usually cannot survive below 0° C and above 37° C.

- A plant's ability to withstand low temperatures is called its **hardiness**
 - A plant which is very hardy can survive in a cold climate
 - It is measured using a plant hardiness zone map
 - Each area of the country is assigned a zone numbered from one to thirteen.
 - The zones are based upon the average coldest temperatures of the year



Plant Hardiness Zone

1	4	7	10	13
2	5	8	11	
3	6	9	12	

The 13 hardness zones are defined as followed:

Zone 1: below -46 C (below -50 F)
Zone 2: -46 to -40 C (-50 to -40 F)
Zone 3: -40 to -34 C (-40 to -30 F)
Zone 4: -34 to -29 C (-30 to -20 F)
Zone 5: -29 to -23 C (-20 to -10 F)
Zone 6: -23 to -18 C (-10 to 0 F)
Zone 7: -18 to -12 C (0 to 10 F)

Zone 8: -12 to -7 C (10 to 20 F)
Zone 9: -7 to -1 C (20 to 30 F)
Zone 10: -1 to 4 C (30 to 40 F)
Zone 11: 4 to 10 C (40 to 50 F)
Zone 12: 10 to 15 C (50 to 60 F)
Zone 13: above 15 C (above 60 F)

- Plants have difficulty growing at extremely high temperatures
 - It usually has to do with the ability to pick up and move enough water to keep up with the higher rate of photosynthesis
 - When it gets too hot, the plant starts to lose water and become flat or limp
 - A condition known as **wilted**
 - The guard cells also wilt, causing the stomata to close, thus effectively shutting the plant processes down

Comparison of Plants Having or Lacking Water

The plant on the left has enough water in its cells to hold it upright. This condition is known as **turgid**.



The plant on the right is lacking the necessary water to hold itself up. This is known as **wilted**.



How Does the Quality of Air Affect Plants?

- Air contains carbon dioxide and oxygen, both of which are necessary for plant growth
 - Oxygen is needed in order for cellular respiration to occur in a normal manner
 - It is mainly picked up by the roots of the plant
 - Carbon dioxide is used for photosynthesis in very high amounts
 - It usually enters the plant through the leaves via the stomata
 - In greenhouses, the levels of carbon dioxide can be boosted in order to increase the rate of photosynthesis



How Do Plants Get Water?

- Plants get most of their water through the root system
 - In some situations, plants can soak up water through their stems or in through their leaves
- One factor that makes watering plants difficult is that the roots need both water and oxygen
 - Some plants tolerate wet medium with less oxygen. Others require well-drained medium with higher levels of oxygen



- Plants should be watered all the way through the root zone to encourage even root growth
- Plants that are grown in pots should have pots with drainage holes, so the water can drain and allow oxygen into the root zone



Summary

- What is the best wavelengths of light that plants need?
- Describe a foot-candle.
- What is a photoperiod?
- Give an example of a SDP, LDP and DNP.
- What is a plant's hardiness?
- What hardiness zone do you live in?



Summary continued

- What causes a plant to wilt?
- Why are oxygen and carbon dioxide necessary for plant growth?
- How can a plant get water? There are three ways.
- How should houseplants be watered?
- Why is it necessary for the pots to have drainage holes?