



How Plants Grow (Basic Botany)



Reference / Supplemental Reading

- **CMG GardenNotes** on How Plants Grow (Botany) available on-line at www.cmg.colostate.edu
 - #121 Horticulture Classification
 - #122 Taxonomic Classification
 - #131 Plant Structures: Cells, Tissues, and Structures
 - #132 Plant Structures: Roots
 - #133 Plant Structures: Stems
 - #134 Plant Structures: Leaves
 - #135 Plant Structures: Flowers
 - #136 Plant Structures: Fruit
 - #137 Plant Structures: Seeds
 - #141 Plant Growth: Photosynthesis, Respiration and Transpiration
 - #142 Plant Growth Factors: Light
 - #143 Plant Growth Factors: Temperature
 - #144 Plant Growth Factors: Water
 - #145 Plant Growth Factors: Hormones
 - #146 Worksheet: Plant Structures
 - #147 Homework: How Plants Grow
- **Reference Books**
 - *Botany for Gardeners*. Brian Capon. Timber Press. 1990.
 - *Gardener's Latin: A Lexicon*. Bill Neal.
 - *Introduction to Botany*. James Schooley. Delmar Publishers. 1997.
 - *Manual of Woody Landscape Plants, Fifth Edition*. Michael A. Dirr. Stipes. 1998.
 - *Hartman's Plant Science, Third Edition*. Margaret J. McMahon, Anthon M. Kofranek, and Vincent E. Rubatzky. Prentice Hall. 2002.
 - *The Why and How of Home Horticulture*. D.R. Bienz. Freeman. 1993.
 - *Winter Guide to Central Rocky Mountain Shrubs*. Co. Dept. of Natural Resources, Div. of Wildlife. 1976.
- **Web-Based References on Plant Taxonomy**
 - *International Plant Name Index* at www.ipni.org
 - *Royal Botanic Gardens, Kew Resource Page* at www.kew.org/data/subjects.html
 - *U.S. Department of Agriculture Plant Data Base* at <http://plants.usda.gov>
 - Several web-based sites offer pronunciation guides for plant names. For example, <http://www.finegardening.com/pguide/pronunciation-guide-to-botanical-latin.aspx>

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Learning Objectives

At the end of this unit, the student will:

- Use correct terminology, enhancing communications and understanding about plants.
- Practice diagnostic skills of judiciously examining plants and plant parts for plant identification.
- Practice diagnostic skills of judiciously examining plants and plant parts and correlating observations with print information in the diagnostic process.
- Correlate plant structure and growth processes with common plant disorders.

Review Questions

Note: Class time does not permit the instructor to cover all the topics. Please take time to read and review study materials.

Note: This unit covers many horticultural and botanical terms. The objective is to understand that terms are used to communicate, and using terms correctly improves communications.

It is not the purpose of this training to memorize terms or definitions. In working as a CMG or gardener, when you come across a term that you don't understand, simply use the glossary in most botany textbooks to look-up the meaning.

Classifying Plants

1. Why is it important to understand the concepts of plant taxonomy and classification as a gardener?
2. Give examples of types of plant classification used by gardeners.
3. Define the following terms:
 - a. Warm season and cool season
 - b. Tender and hardy
 - c. Hardiness and hardiness zone
 - d. Alpine, prairie, woodland, wetland, xeric, and native plants
 - e. Herbaceous and woody
 - f. Trees, shrubs, and vines
 - g. Deciduous, evergreen, and semi-evergreen
 - h. Broadleaf, narrowleaf, and needleleaf
 - i. Annual, summer annual, and winter annual

- j. Biennial
- k. Perennial, herbaceous perennial, spring ephemerals, and woody perennials

4. Outline the taxonomic classification for *Pterophyta* (ferns), *Ginkgophyta* (ginkgo trees), *Coniferophyta* (conifers), *Monocotyledon* (monocots), and *Dicotyledon* (dicots).
5. Why is it important to know the difference between monocots and dicots, especially when it comes to applying herbicides?
6. How can you identify monocots and dicots based on vascular bundle arrangement, leaf venation, flower parts, and seed cotyledons?
7. Why do horticulturists typically deal with plant families?
8. Give the protocol for writing scientific names. What is the difference between “sp.” and “spp.”? Is *Gleditsia triacanthos inermis* a properly written scientific name for thornless honeylocust? Explain.
9. Define the following terms:
 - a. variety
 - b. cultivar
 - c. clone
 - d. line
 - e. group
 - f. strain
 - g. form

Plant Structures

10. Describe the relationships of *cells*, *tissues*, *structures*, and *plants*.
11. List the three primary functions of roots.
12. What percentage of plant problems begin as soil and root disorders?
13. Define and identify the following root terms.
 - a. Meristematic zone
 - b. Zone of elongation
 - c. Zone of maturation
 - d. Primary roots
 - e. Lateral roots

- f. Root tip
 - g. Root cap
 - h. Epidermis
 - i. Root hairs
 - j. Cortex cells
 - k. Central vascular cylinder (vascular tissues)
 - l. Tap root system
 - m. Fibrous root system
 - n. Adventitious roots
14. List the three primary functions of stems.
15. Describe and identify the vascular bundle arrangement for monocot stems, non-woody dicot stems, and woody dicot stems.
16. On a stem, identify the following parts:
- a. Nodes
 - b. Internodes
 - c. Terminal bud
 - d. Lateral bud
 - e. Terminal bud scar
 - f. Leaf scar
 - g. Bundle scar
17. Describe how stem characteristics are used in plant identification.
18. Define the following stem terms:
- a. Shoot
 - b. Twig
 - c. Branch
 - d. Trunk
 - e. Cane
 - f. Bulb
 - g. Corm
 - h. Crown
 - i. Stolon
 - j. Rhizome
 - k. Spur
 - l. Tuber
 - m. Tuberous stem
19. List the two primary functions of leaves.
20. Describe and identify leaves from conifers, ginkgo, monocots, and dicots.
21. Define and identify the following leaf terms.
- a. Leaf blade
 - b. Leaf tip
 - c. Leaf base
 - d. Mid-vein or midrib
 - e. Lateral veins
 - f. Leaf stalk or petiole
 - g. Stipules
 - h. Bud
 - i. Pinnate venation
 - j. Palmate venation
 - k. Parallel venation
 - l. Simple leaf
 - m. Pinnately compound
 - n. Palmately compound
 - o. Double compound
 - p. Alternate leaf arrangement
 - q. Opposite leaf arrangement
 - r. Whorled leaf arrangement
22. Describe how stem characteristics are used in plant identification.
23. With compound leaves, how can you tell what is a leaf and what is a leaflet?
24. What is the primary function of flowers?
25. On a flower, identify the following parts:
- a. Sepals
 - b. Calyx
 - c. Petals
 - d. Corolla
 - e. Anthers
 - f. Filament
 - g. Stamen
 - h. Stigma
 - i. Style
 - j. Ovary
 - k. Ovules
 - l. Pistil
 - m. Receptacle
 - n. Pedicel
 - o. Floret

26. Define the following flower and plant terms.
- Complete flower
 - Incomplete flower
 - Perfect flower
 - Imperfect staminate flower
 - Imperfect pistillate flower
 - Hermaphroditic plant
 - Monoecious plant
 - Dioecious plant
27. Describe how flowers are used in plant identification.
28. What is the primary function of fruit?
29. On a seed, identify the following parts:
- Seed coat
 - Endosperm
 - Cotyledon
 - Plumule
 - Radicle
 - Hypocotyl
 - Epigeous emergence
 - Hypogeous emergence
30. Describe the difference between monocot and dicot seeds.
31. Review *thought questions* on the first page of fact sheets.
32. List the seven degrees of sun and shade.
33. What is the photoperiod? For long and short day plants, give the response (i.e., vegetative or flowering) for long and short nights. What happens if the night is interrupted?
34. Give examples of crop responses to warm and cold temperatures.
35. List factors that influence plant hardiness.
36. What does a hardiness zone map indicate?
37. How does a sudden dramatic drop in winter temperatures impact hardiness? How does a gradual yet significant drop in winter temperatures impact hardiness? How does early spring warming or late spring frost affect hardiness?
38. Define the following terms related to winter injury:
- Sunscald
 - Frost crack
 - Frost shake
 - Winter drought
 - Rapid change in temperature
 - Photo-oxidization of chlorophyll
 - Tissue death due to low temperature
39. How do temperate-zone plants know when to start growing in the spring?
40. List the roles of water in plant growth.
41. Give common symptoms of drought stress and waterlogged soils.
42. What are the symptoms of leaf scorch? List factors that contribute to leaf scorch?
43. Define plant hormones and plant growth regulators.
44. Explain how a plant balances shoot growth with root growth.
45. Explain how a plant grows toward the sun. Explain how a plant knows up from down.
46. Review *thought questions* on the first page of the CMG GardenNotes.

Plant Growth

32. Give a simple equation for photosynthesis and respiration.
33. Define
- Photosynthesis
 - Respiration
 - Chloroplasts
 - Chlorophyll
 - Transpiration
 - Stomata
34. What percentage of plant water is used for transpiration? Transpiration accounts for what percentage of the cooling effect of trees?
35. List the functions of transpiration.