



CMG GardenNotes #210

Soils, Fertilizers, and Soil Amendments References and Review Material

Reading/Reference Materials

CSU GardenNotes

- <https://cmg.extension.colostate.edu/volunteer-information/cmg-gardennotes-class-handouts/>.
- #211, *Introduction to Soils*.
- #212, *The Living Soil*.
- #213, *Managing Soil Tillage: Texture, Structure, and Pore Space*.
- #214, *Estimating Soil Texture: Sandy, Loamy, or Clayey*.
- #215, *Soil Compaction*.
- #218, *Earthworms*.
- #219, *Soil Drainage*.
- #221, *Soil Tests*.
- #222, *Soil pH*.
- #223, *Iron Chlorosis of Woody Plants*.
- #224, *Saline Soils*.
- #231, *Plant Nutrition*.
- #232, *Understanding Fertilizers*.
- #233, *Calculating Fertilizer Application Rates*.
- #234, *Organic Fertilizers*.
- #241, *Soil Amendments*.
- #242, *Using Manure in the Home Garden*.
- #243, *Using Compost in the Home Garden*.
- #244, *Cover Crops and Green Manure Crops*.
- #245, *Mulching*.
- #246, *Making Compost*.
- #251, *Asking Effective Questions About Soils*.

CSU Extension Fact Sheets

- <https://extension.colostate.edu/topic-areas/yard-garden/>.
- #0.501, *Soil Testing*.
- #0.503, *Managing Saline Soils*.
- #0.504, *Managing Sodic Soils*.
- #0.520, *Selecting an Analytical Laboratory*.
- #0.521, *Diagnosing Saline and Sodic Soil Problems*.

- **Recommendations for plants that tolerate high alkaline/high pH soils:**
 - #7.220, *Colorado Gardening: Challenge to Newcomers*.
 - #7.421, *Native Trees for Colorado Landscapes*.
 - #7.422, *Native Shrubs for Colorado Landscapes*.
 - #7.214, *Mulches for Home Grounds*.

Planttalk Colorado™

- <https://planttalk.colostate.edu/>.

Learning Objectives

At the end of this training, the student will be able to:

- Describe characteristics of a typical landscape soil and how it differs from native or agricultural soils.
- Describe how soil organisms directly and indirectly benefit the soil and plant growth.
- Describe management practices effective in nurturing soil organisms.
- Describe the relationship between soil texture, structure, pore space, and tilth.
- Describe effective management practices for sandy soils, clayey soils, and decomposed granite rocky soils.
- Describe effective management practices to prevent and reduce soil compaction.
- Describe considerations in selecting soil amendments.
- Describe considerations in selecting mulch.
- Describe considerations in selecting appropriate fertilizers.

Review Questions

Introduction To Soils

1. Explain how soils may vary horizontally and vertically. Describe characteristics of the A, B, and C soil horizons.
2. Describe how landscape soils differ from agricultural and native soils.
3. Describe the typical percentage of air, water, organic matter, and mineral solids for a native soil. How does this change for a compacted landscape soil?

The Living Soil

4. Describe how organisms directly benefit the soil and plant growth.
5. Describe how organisms indirectly benefit the soil and plant growth.
6. Should gardeners inoculate their soil with rhizobia, mycorrhizae, and decomposers?
7. What makes up the soil organic matter? Define humus.
8. How does a gardener enhance the living soil? How can a gardener damage soil life?

Managing Soil Tilth

9. Define the terms soil texture, soil structure, and soil profile. Explain how they are interrelated.
10. Describe characteristics of the following soil types:
 - Coarse-textured, sandy soil.
 - Fine-textured, clayey soil.
 - Gravelly and decomposed granite soils.
11. Explain what is significant about large pore spaces and small pore spaces.
12. Describe how water moves through small pore spaces and large pore spaces.

13. In relation to root growth, air infiltration, and water movement, what happens when the soil has a texture interface?
14. Explain management of fine-textured clayey soils, coarse-textured sandy soils, gravelly and decomposed granite soils.

Soil Compaction

15. Describe soil compaction in terms of pore space, water movement, and air infiltration.
16. List techniques to prevent soil compaction. List techniques to mitigate soil compaction.

Soil Drainage Problems

17. Describe drainage problems as related to pore space, surface runoff, and leaching.
18. Why is it important to identify the causes of a drainage problem before attempting corrections?
19. List common causes of surface drainage problems with possible corrective actions. List common causes of sub-surface drainage problems with possible corrective actions.

Soil Tests

20. List situations when a soil test would be helpful. List examples of plant growth problems for which a soil test would not be helpful. Which nutrient is typically not accurately measured on a single soil test?
21. Describe the steps to a soil test.
22. Where does one find a list of soil testing laboratories?

pH and Iron Chlorosis

23. What does soil pH measure? What is an acceptable range for most plants? What are the implications for gardening in Colorado?
24. Describe the function of the free lime vinegar test. Can the pH of an alkaline soil be effectively lowered?
25. Describe the symptoms of iron chlorosis. What other situations can be confused with iron chlorosis? How can you tell them apart?
26. List primary factors that contribute to iron chlorosis.
27. What simple method identifies soils prone to iron chlorosis problems?
28. Describe the limitations and application criteria for the following iron treatments:
 - Soil applications of sulfur.
 - Soil applications of iron sulfate plus sulfur.
 - Soil applications of iron chelates.
 - Foliar sprays.
 - Trunk injections.

Saline Soils

29. Describe plant problems associated with excess soil salt levels.
30. List sources/causes of high soil salts.
31. Describe the leaching process for salty soils. What about situations when excess salts cannot be leached out?
32. Describe other management strategies for salty soils.

Plant Nutrition

33. Define plant nutrient and fertilizer.
34. Will the addition of nitrogen fertilizer help plant growth when soil compaction is the limiting factor? Explain.
35. What are the typical symptoms of nitrogen deficiency? What are the problems associated with excessive nitrogen fertilization?

36. In Colorado soils, under what situations will phosphorus levels likely be adequate and likely be deficient? How does one determine the need for phosphate fertilizer?
37. In Colorado soils, under what situations will potassium levels likely be adequate and likely be deficient? How does one determine the need for potash fertilizers?

Fertilizers

38. Define the following terms: organic fertilizer, certified organic fertilizer, and soil amendment.
39. What does grade or analysis indicate about a fertilizer? What is the fertilizer ratio?
40. What is a fertilizer formulation? What is a complete fertilizer? When applying a complete fertilizer, what is the application rate always based on?
41. What is the routine application rate for nitrogen fertilizer? How does it change based on soil organic matter? What is the routine application rate when using these fertilizers?
 - Ammonium sulfate, 21-0-0.
 - Ammonium nitrate, 34-0-0.
 - Urea, 45-0-0.
42. Address your answers relative to phosphorus water pollution. What happens to phosphate fertilizers applied 1) to a lawn or garden area, and 2) over-spread onto the street, sidewalk, or driveway? What is the major source of phosphate water pollution from the landscape setting?

Soil Amendments

43. Explain the differences between soil amendments, mulch, and compost.
44. Explain how organic soil amendments improve a clayey soil and a sandy soil.
45. Describe considerations in selecting a soil amendment as it relates to the following:
 - Desired results.
 - Potential for routine application.
 - Longevity.
 - Salt.
46. What is the routine application rate for soil amendments? What is a precaution about adding additional amounts?
47. Explain the use and limitations of using manure as it relates to:
 - *E. coli*.
 - Nitrogen release rates.
 - Salt.
 - Weed seeds.
48. What are cover crops and green manure crops? List benefits of cover-cropping and green manuring.